

THE
JOURNAL
OF THE
BOMBAY NATURAL HISTORY SOCIETY.

EDITED BY
H. M. PHIPSON, C.M.Z.S.,
Honorary Secretary.

VOL. VII.

*Consisting of Five Parts and containing
Twenty-six Illustrations.*

Dates of publication.

Part I. (Pages 1 to 124)	..	..	-	..	1st June	1892
„ II. (Pages 125 to 262)	...	-	-	..	1st Oct.	1893
„ III. (Pages 263 to 412)	...	..	.	...	15th Jan.	1893
„ IV. (Pages 413 to 561)	...	-	-	..	23rd April	1893
„ V. (Index, &c.)	..	-	-	..	1st August	1893

Bombay:
PRINTED AT THE
EDUCATION SOCIETY'S STEAM PRESS, BYCULLA.

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* Named *Elachura koptodonta* in the text.

ERRATA.

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p. 391, 9th line, last word, *for* "Kalahint" *read* "Kulrhint."

p. 397, 3rd line, *for* "are" *read* "viz."

p. 399, 13th line, *for* "Barking" *read* "Hog."

Same page, *for* "Prejevalisky" *read* "Prejevaljsky."

JOURNAL
OF THE
BOMBAY
Natural History Society.

No. 1.]

BOMBAY, 1892.

[Vol. VII.]

THE BULBULS OF NORTH CACHAR.

By E. C. STUART BAKER.

PART I.

(With 2 Plates.)

(Read before the Bombay Natural History Society on 5th April, 1892.)

ZANTHIXUS FLAVESCENS.

BLYTH'S BULBUL.

Oates' "Avifauna of B. India," No. 287., Vol. I., p. 275. id., B.B.B., Vol. I., p. 193. Murray's "Avifauna," Vol. II., p. 39. Hume, Cat. No. 452 bis.

DESCRIPTION.—Forehead and crown dark brown, the feathers edged olive-yellow and sub-edged grey. Upper plumage olive-brown, tinged flavescent on the rump. Wings olive-brown, edges of quill-feathers olive-green. Tail olive-brown, shafts rather darker brown. Lores black, short supercilium from base of upper mandible yellowish white; cheeks and ear-coverts greenish-grey; chin pale grey; throat, breast, and flanks grey, more or less suffused with yellow; centre of abdomen flavescent; under tail-coverts bright yellow. Bill and legs black; irides dark brown.

Length 8·2 in.; tail 4 in.; wing 3·3 in.; bill at front ·4 in., and from gape ·65 in.; tarsus ·8 in.

The feathers of the tail are rather strongly graduated, the centre pair exceeding the outermost by rather more than three-quarters of an inch.

NIDIFICATION.—The nest is very much like that of the common bulbul (*P. pygæus*); but on an average I think it is proportionately shallower. The first I ever saw was composed outwardly entirely of very dark-coloured materials, the only light thing about it being one small yellow leaf woven into the base amongst the other materials; these consisted of black fern roots, dark brown twigs, and tendrils of climbing plants. The lining was composed of the ends of some grass denuded of the seeds, which in colour was a bright tan. Another nest, obtained later on, was composed largely of dead leaves and twigs interwoven with, and bound together by, roots, further strengthened here and there with a few cobwebs. The lining was of the same flowering grass ends as in the other. I do not know the name of the particular kind of grass from which it is taken, but when a quantity is put together it has exactly the appearance of "klus-khus." Of five other nests which I have taken, three were much like the one first mentioned, and two others were of an intermediate type between that and the other one. All seven nests are rather dark, even such leaves as are used in their construction are generally of a dark brown or dead green shade, rather than of the commoner colours, yellows and reds. In shape, as already mentioned, they are shallow cups, very neatly and firmly made. The majority of those I have taken were placed in between *several* upright twigs, these being only partly brought into the sides of the nest by the circumscribing materials. The average of five of the nests was rather less than four inches in diameter; in depth none exceed 1·5 in., varying between that and 1·2 in. The internal measurements are about 3·2 in., by ·8 in. depth. All the nests were taken from low bushes close to the ground. The highest was found at about five feet, the majority between two and three and-a-half feet. The birds take great pains to conceal them well, and it often requires careful searching before they can be found. The parent bird, moreover, generally leaves the nest very silently, and at once quits the neighbourhood. On one occasion only—and

then there were young—did the birds at all assist me in finding their nest by hovering about in its vicinity. Of the seven nests two contained three eggs each and one contained only two. Of the others one nest had but a single egg in it and the remaining two were empty. My nine eggs average in size .96 in. by .58 in. They vary in length between .93 in. and 1.00 in., and in breadth between .56 in. and .60 in.

The ground-colour is a faint, very delicate cream, and they are freckled with specks and tiny irregular blotches of brownish-pink and with others again, subordinate to these, of pinky-grey, appearing as if below the shell. The markings form a very distinct ring in the greater number at the larger end, and here too there is a dull purplish tint caused by very indistinct, cloudy markings of pale neutral tint. In about half the eggs, also confined to the larger end, there are a few exceedingly fine, short, hair-like marks, the colour of clotted blood or of dark brown.

Of all bulbuls' eggs these are, I think, the most elongated, but at the same time they are obtuse rather than pointed. The shell is very fragile and soft in texture, the surface is smooth but quite glossless.

During the cold weather I have seen this rare bulbul as low down as 1,500 feet, but after April they appear all to ascend above three thousand feet, and many go to the highest peaks, nearly 7,000 feet high. They keep to much the same sort of ground as *Otocompsa flaviventris*, and like them assemble in flocks from September to April. The flocks appear to differ much in their proportions; I have seen over thirty collected together, and again I have observed flocks consisting of only half a dozen individuals. They are rather silent birds, when not quarreling (a vice they are rather given to), and they do not seem to have any song worthy of the name; and most of their other notes resemble the conversational notes of *O. pygæus* and *burmannicus* very closely, though they are distinguishable by any one who has studied the different bulbuls' voices.

They are shy birds and impatient of close observation. They are quite impartial as to their feeding grounds, visiting high trees and low bushes alike.

They breed, as far as I know, in June and July, but a wide

knowledge of their habits will probably show that they also breed in May.

They do not break up their flocks until very late in April, so that it is unlikely that they will be found building in that month.

They eat both fruits and insects, but principally the latter.

CRINIGER FLAVICOLLIS.

THE WHITE-THROATED BULBUL.

Jerdon B. of In., Vol. II., p. 83. Oates' Fauna of India, Vol. I., p. 255. id. Hume's Nests and Eggs, Vol. I., p. 162. Murray's Avifauna, Vol. II., p. 84. Hume, Cat. No. 451.

DESCRIPTION.—Forehead, lores and cheeks and a supercilium greyish-white; ear-coverts grey, varying very much in depth; chin and throat white; remainder of head light olive-brown, the feathers all more or less edged with yellowish-green; whole upper plumage and lesser wing-coverts olive-green, remainder of wings brown, the quills edged with olive yellow on the outer webs; lower plumage bright, light *King's* yellow; tail rufescent-brown.

Bill pale greyish-blue, gape and mouth still paler; irides deep red; legs greyish-horny, pale bluish-horny or fleshy-grey.

Length 8·7 in.; tail 3·3 in.; wing 3·7 in.; tarsus ·75 in.; bill at front ·68 in. and from gape ·9 in.

Oates makes no mention of any white supercilium, but I find some trace of this in all the birds obtained in these Hills. In the majority it is well developed and very strongly defined, but in others it is much less distinct though always perfectly apparent. The grey of the ear-coverts, as above mentioned, varies very much; in a few specimens it is no darker than the lores and cheeks, whilst in some it is sufficiently dark to make a decided contrast with those parts.

NIDIFICATION.—The nests, of which I have taken some thirty, are all much of the same type, and are made as follows:—The outside of the nest is composed of dead leaves and bamboo spates *rather* strongly fastened together with a few hair-like fern roots and a number of elastic stems of weeds; inside the outer shell, which can be stripped off without damaging the remainder of the nest, there are a few more dead leaves *very* strongly bound together by innu-

merable fern roots, all of the finest description, and, also, all black, so firm is this part of the nest that if the outer part and the lining be taken away, a strong and perfect cup remains capable of withstanding considerable force. The true lining is composed entirely of coarse fern roots, very rarely of fine twigs. These three portions of the nest as a rule shew three distinct shades of colour, the outermost part, in the material of which dead leaves predominate, is of a yellow or light reddish, the fine fern roots cause the central part to appear of a dead, dull black, whilst the innermost is nearly always of a dark reddish-brown. In shape the nest is a rather shallow cup, averaging, in internal diameter about 2·6," and in depth a little over an inch. The outer dimensions of course depend much on the amount of materials used and the compactness with which they are fastened together. The greater number of nests will be found to somewhat exceed 4·5" by 2·5," and very few will be taken smaller than this. Oates states that they build in small trees at heights never above 10 feet from the ground; amongst the large number of nests that I have personally taken, I have never seen one above four feet from the ground, and many are placed within a few inches of it, or amongst roots and herbage, and practically, if not actually, on it. From its position the nest is more often than not very wet and heavy, but so well is it made that the lining keeps beautifully dry and warm. The eggs are very beautiful. In character they shew but little variation, though much in the *extent* of their markings: the ground-colour varies from a pale to a warm deep pink, always rather bright in tint; the primary markings consist of irregular lines, specks, spots and small blotches of different shades of blood and maroon-red, the majority dark, some light, and a very few quite pale; the secondary markings, which are usually very few in number and often absent altogether, consist of specks and freckles of grey and purple-greys; I do not remember ever having seen any lines of this colour. The markings usually tend to form a ring at the larger end, the spots and lines here running into one another and being rather blurred, elsewhere the spots are very few; in a few eggs they form an ill-defined cap, and in a very few they are fairly equally distributed over the whole surface of the egg. I have two or three clutches in which the character of the markings is very smudgy, and they are

also more numerous—much as in the eggs of *Pycnorhis*—and a couple of other clutches in which the markings consist almost entirely of lines. In nine out of ten eggs many of the spots will be found to be in the shape of tiny horse shoes.

The eggs are very glossy, the shell is compact and smooth, and decidedly stronger than the majority of bulbuls' eggs.

In shape they are typically rather long, obtuse ovals, though frequently rather drawn out towards the smaller end. Abnormal specimens are rare, and, such as there are, are generally of a broader, more obtuse shape.

In length my eggs range between 8·9" and 1·1," and in breadth between '68" and '74". The average length of 35 eggs is '99" X '72". In number they are generally two, very rarely three; never, that I know of, four.

I have only taken the eggs of this bulbul in May and June, the earliest date I have recorded amongst my notes being the 4th of May last year, 1891, and the latest the 24th of June, 1888. I have, however, found young, unfledged, in August, and I also once found a nest containing young ones on the 2nd of May. They do not often seem to breed in these Hills below 3,000 feet, and I have found most of my nests above 5,000 feet.

This bird, like the greater number of species of this sub-family, is gregarious throughout the cold weather, but is never found in very large flocks; as a rule they number some eight or nine individuals, often only four or five and never more than twelve or fourteen; they keep very much to the smaller trees and bushes, the cause of this doubtless being the fact that they are more exclusively fruit eaters than most bulbuls, and find their food more plentiful and easily obtained in such situations, for, they will ascend very lofty trees, when these are in bearing, to feed on the berries.

It is wonderful what enormous things these birds contrive to swallow whole: I took from the stomach of a bird, a short time ago, two large berries of a babool-like tree, *Phyllanthus emblica*, which completely filled it, extending the walls to their utmost limit; these berries are of a sort very common in these hills, acid to the taste, and in colour pale green; they form a favourite article of diet with monkeys, deer, squirrels, etc., and many kinds of birds.

I have never heard this bird uttering any song, indeed most of its cries are very harsh and loud, though it has one rather sweet loud note which it frequently uses, unfortunately nearly always in conjunction with many others far less pleasant.

Its flight, for a bulbul's, is strong and very direct, but it seems seldom to make use of its wings for any distance at a time. It is found principally on the outskirts of heavy and in the interior of light forest, generally selecting ground with a considerable amount of undergrowth.

I have never seen it below 2,500 feet except in the cold weather; it appears to be most common between three and four thousand feet at that season, ascending higher during the breeding time, when it may be obtained on the very highest peaks.

FLEMIXUS FLAVALA.

BROWN-EARED BULBUL.

Jerdon B. of In. No. 448, Vol I., p. 80. Oates' B. B. B. No. 272, Vol. I., p. 175; id. Avifauna of B. I.; Vol I., p. 263. Murray's Avifauna of B. I., Vol II., p. 20.

DESCRIPTION.—Head grey, the feathers centred darker; remainder of upper plumage, lesser and median wing-coverts dark grey; in some birds the upper tail-coverts are tinged with olive-yellow but in most they are quite plain grey; greater wing-coverts dark grey with nearly the whole of the outer webs olive-yellow; primaries brown, all but the first three narrowly edged with olive-yellow, secondaries the same but with the yellow margins broader, whilst in the inner secondaries the greater portion of the outer webs are of this colour. The tail is of a rather lighter brown than the wing, the feathers being margined with yellow in the same way as the wing quills. Lores and cheeks velvety-black; ear-coverts golden-hair-brown; chin and upper throat white; breast and flanks grey, of a paler shade than the back and fading to white on the abdomen; under tail-coverts white.

Some birds have the under parts tinged with flavescent during the cold weather, it is always, though, extremely faint.

The female, though not much shorter, is a much more slender bird, and the crest, also, never appears to be so well developed.

Bill black, irides dull crimson or reddish-brown; the legs vary much between horny-brown and dark plumbeous, in a few specimens being almost black.

Male, length 8·4"; tail 3·4"; wing 3·9"; tarsus ·72"; bill at front ·6" and from gape ·98".

Female, length 8·1"; tail 3·2"; wing 3·8".

NIDIFICATION.—The nest is a rather deep cup composed outwardly of grass stems and dead leaves, and lined with coarse grass stems.

The general appearance of the nest is a bright tan-brown and it looks as if made of "kus-kus" or some similar material. Occasionally the whole nest is constructed entirely of grass stems, but at other times a good many bamboo leaves are used as well as coarse grasses and a few fine twigs, and, in one nest, I also found a few fern roots and a scrap or two of moss. It is a very compact, strongly built nest; externally they average about 3·5" by 2·5," and inwardly the diameter is about 3" or rather less, and the depth from 1·6" to ·2". The nest is almost invariably placed close to the ground, generally at about three or four feet from it, and never, to my knowledge, above five feet. Most of my nests were taken from wild lemon trees growing at a place over 6,000 feet high, but I have found one nest below 2,300 feet, and have seen many birds at about that elevation during the breeding season. All the nests were taken from scrub jungle with one exception, and that one was found *almost* on the ground by a hill path passing through forest. This last nest was very beautifully hidden in an overhanging bunch of creepers being half supported by them and half by a bunch of coarse grass. I should never have found it but for the assistance of the parent birds, who kept hovering about and *screaming* loudly whenever I approached too close.

My eggs are all of one type; the ground-colour a lovely pale pink, covered with numerous spots and freckles of pinky-red which are slightly more numerous at the larger end.

I have one or two eggs of *O. flaviventris* which resemble them in all but size, and a clutch of eggs of *Spisirox canifrons* which are quite undistinguishable from them.

The average size of twelve eggs is ·93" X ·71".

The greatest and least length is ·96" and ·88", and the greatest and least breadth ·73" and ·69".

There is the full complement of eggs, rarely only two, never I think, four. In shape they are rather long regular ovals, in texture typical bulbul's. This bird is fairly common throughout the district, descending during the cold weather far into the plains and ascending to the highest peaks during the hot weather and rains. In the former season, during which time it assembles in flocks, it frequents fairly open country, roadsides, and the edges of patches of cultivated land. It keeps exclusively neither to high trees nor to low bushes, visiting either the one or the other as the chances of obtaining food present themselves. The flocks are very large and I have counted over thirty in one; as in addition to this, their numerical strength, they are exceedingly noisy, it is by no means easy to overlook them. I was once at a place on the banks of a big stream where there were several large trees, then in bearing, to which these birds came to feed every morning and evening. From daylight until about 9 a. m. they were industriously feeding and keeping up a continuous loud chuckling and chattering, giving every now and then a clear whistle. After 9 o'clock the whole flock flew away, retiring to some deep, shady forest close by, from which they returned to feed at about half-past three or four p. m.

They shewed themselves to be very amiable characters, refusing to fight with any of the other species of birds engaged in feeding on the same trees, and at once gave up their perch to any other bulbul or barbet who chose to take it.

I noticed that they were the earliest of all the birds to retire; they went away some time before sunset and began to settle themselves in a clump of bamboos where they are accustomed to roost.

The flocks must break up very early as I have never seen any after the first few days of March, though I constantly meet with single birds much later on in the year.

About the middle or end of April they ascend to higher elevations where they remain during the breeding season. At this time much less is seen of the birds, as they withdraw to deeper forest, keeping in a great measure to nullahs and ravines, more especially to those through which water runs.

They have a pleasant but rather jerky song which they sing all the year through, as well as in the breeding season. I have heard it

repeatedly in December, January and February during which latter month the birds are still collected together.

These birds have a very peculiar habit of seating themselves at the extreme end of a thin overhanging bamboo and swinging with the breeze. The small solitary bamboo, *Bambusa vulgaris*, when still young, is exactly like an extremely pliant fishing rod, and the end of one of these forms a very favourite perch with this bulbul. I have often seen a pair of them thus seated, close together and evidently enjoying the motion of awaying backwards and forward in the wind. They are not exactly shy birds, but they will not allow nearly as close an approach as *Iole* does, unless they are in trees with very thick foliage when they trust to escape being seen. If any one approaches such a tree in which a flock of these birds are feeding, and of course also chattering, a dead silence ensues directly they see him, and until the undesired presence is withdrawn, no more conversation is carried on.

During the breeding season they become more wild, and it is then often rather difficult even to get within shot of them.

SPIZIXUS CANIFRONS.

THE FINCH BILLED BULBUL.

Oates' Fauna of India, Birds, Vol. I., p. 280, id. Hume's Nests and Eggs, Vol. I., p. 184. Hume, Cat. No. 453 bis. Murray's Avifauna of B. I., Vol. II., p. 48.

DESCRIPTION.—Forehead, running up in a point into the crown, grey; lores mixed grey and black, crown and round the eye black; chin and cheeks, mixed grey and black; ear-coverts grey tinged with hair-brown on the upper part, nape and sides of neck grey, chin dark brownish-grey. Whole upper plumage bright olive-green, lightest on the rump and upper tail-coverts, and darkest on the scapularies and interscapularies; wing-coverts the same tinged with brown on the inner webs of the greater coverts; primaries and secondaries dark brown on the inner and yellowish-green on the outer webs, inner secondaries green on both, but more or less tinged with brown on the inner webs. Tail yellowish-green, with a band, an inch wide, of dark brown at the tips. Lower plumage dull greenish-yellow, brightening to yellow on the belly and under tail coverts. Bill very

pale straw-white, legs and feet dull deep flesh-colour, iris red-brown to pure vandyke-brown.

Length 8·4"; wing 3·7", tail 3·9"; bill at front 5·4" and from gape 7·5"; tarsus 7·5".

The woodcut representing the head of this bird in the Blandford series *Avifauna*, makes the crest too bushy and the feathers not long enough or sufficiently pointed. The crest is more like that depicted in the woodcut of *Hypsipetes paraides*. The hairs springing from the nape are rather numerous in this species, the nostrils are almost concealed.

NIDIFICATION.—The nests that I have taken of this bird differ from those of any other bulbul. The material of which they are made consists almost entirely of coarse and strong tendrils with perhaps a few fine elastic twigs added here and there. There is seldom any lining beyond a few scraps of withered bracken; but I have noticed that the tendrils used for the inner portion of the nest are generally finer than those used for the outer portion; another peculiarity is that the inner tendrils are usually of a reddish colour, whilst those of the outside are of different shades of brown, pale enough to contrast with the former. The nests are fairly strong, but by no means tidy, the tendrils hanging in festoons all about them. A nest, now before me and taken on the 5th May this year, measures internally about 2·7" in diameter by 1" in depth. It is an exact miniature of nests of the genus *Ianthocincla*, especially *rufogularis*. All the nests I have taken have been placed in scraggy bushes and sapplings at heights varying from five to ten feet from the ground; they are generally fixed in between several upright twigs, sometimes in a stoutish fork.

I have never taken a nest below 4,000 feet, and the majority have been found at over 5,400; they breed in considerable numbers on the Hungrum peak.

The earliest date on which I have taken eggs was on the 30th April this year (1891); my latest dates recorded are the 16th June 1890, and 16th June, 1888. The eggs vary very greatly in colour, but the type most often found is as follows:—Ground-colour pale pink freckled all over with primary spots of dull reddish and underlying ones of pale dusky and purplish: these markings generally tend

more or less to coalesce at the larger end, forming a blurred cap or ring of deep dull purplish, with here and there a short fine line of black or reddish-black. In some eggs the markings are rather larger, being more blotches than freckles, but they are nearly always both numerous and dark. In 1887 I took one clutch, and in 1888 another, and in 1891 again one, in which the freckles were very pale and the eggs resembled those of *Xanthikos flarescens* very closely. The typical shape is a rather long regular oval. Twenty eggs average exactly 1" by .7". They vary in length between 1.12" and .9", and in breadth between .66" and .73".

There appears to be scarcely anything on record concerning this bird, and personally I have very seldom observed it except during the breeding season. It is by no means common even where found, and is very local in its distribution. As far as I have been able to ascertain, it is confined to the Hills above 4,000 feet, and generally above five, the one exception to this is a place called Laishang, a valley at an altitude of some three thousand feet and surrounded by high rocky peaks on which a few of these birds may always be found and from which they sometimes wander a short way down the valley. The few birds that I have noticed during the cold weather were in small flocks and engaged in feeding rather high up in biggish trees. In the breeding season the flocks break up and the birds become extremely wild and shy, continually skulking about low down in thick scrub and similar jungle. Their notes are loud, full and rather sweet, of very bulbul-like character, but at the same time easily distinguished from the cries of the other members of this family.

It appears to be found no lower down in the cold weather than in the rains. The stomachs of those birds which I have examined were full of insects, chiefly small beetles, and also a few hard seeds of sorts. In one bird I found the remains of various soft winged insects, including a small moth and many metallic winged-flies; from another I extracted several tiny pieces of yellow gravel, all of the same size and shape, viz., regular ovals of about .05" in length by about .01" in breadth at the centre.

I once shot a pair of these birds who were feeding on a *Ficus* in company with a flock of *Hemizus flavala*.

(To be continued.)

OUR ANTS.

BY ROBERT CHARLES WROUGHTON, F.E.S., Deputy Conservator
of Forests, Poona.

PART I.

With Plates A and B.

(Read before the Bombay Natural History Society, 5th April, 1891.)

I HAVE only come across two papers treating of the manners and customs of 'our' ants (if I except a very short and very inaccurate paper which appeared in "Science Gossip" many years ago). One of these by Mr. Rothney has been reprinted in this Journal, and the other will be found in "Tribes on my Frontier." In the latter E. H. A. has drawn a humorous but life-like picture of a few of the commoner species. The colonizing ant of his Bath-Room is a *Dorylus*; its black enemy is *Camponotus compressus*. The "red ant of Matheran" is of course *Ecophylla smaragdina*; the lively black bungalew ant is certainly *Prenolepis longicornis*, and the 'brown' ant almost as certainly *Monomorium basale* (= *vastator*) though the name given is a libel, for *basale* is really a handsome yellow with a black abdomen. His agricultural ant is a *Holcomyrmez*, and finally his hunting ant is a *Poncrice*, and most likely a *Lobopelta*, but there is less detail than usual in the notice of this species. The facility with which I have been able to recognize these species, from E. H. A.'s descriptions, has emboldened me to think that a record of the manners and customs, which have come under my notice in the last few years, during which I have been paying special attention to the ants, would not be without value. I am glad to know that Dr. Farel, who has been so kind in identifying and, where necessary, describing and naming my specimens for me, intends to publish in this Journal the result of his labours. I propose therefore to avoid all technical descriptions. I shall try, however, wherever possible, to record any characteristic feature which may help to the recognition of any species. In the following notes my facts are facts, or have presented themselves to me as such, but my generalizations must be taken *cum grano salis*. No one is better aware than myself how many-sided is the psychology of an ant; how differently is her

brain constituted from ours and, consequently, how dangerous to generalize from insufficient data. However "working hypotheses" are a necessity, and I have tried to "put myself in *her* place" (I have always tried to remember that ants are practically all females and 'advanced' females at that) and have enunciated wherever possible a theory. I shall be only too glad if others will collect and record facts enough to upset one or all of them. I propose to do so myself, if I can.*

The Order *Hymenoptera*, of the sub-kingdom *Insecta*, was divided by Latreille into two primary sections, which are still retained. Kirby in his "Elementary Text Book of Entomology" writes, "It (*i.e.*, the Order *Hymenoptera*) is primarily divided into *Hymenoptera terebrantia*, in which the ovipositor is used as a borer, and the "*Hymenoptera aculeata*, in which it is modified into a sting." The ants are usually ranked as the first Family of the *aculeata* which, considering their social organization, so closely resembling, and even surpassing to some extent, that of the Bees and Wasps (for these latter have in no case a 'soldier' caste or form) seems surprising. The reason probably is that in one whole sub-family of the ants, *viz.*:—the *Formicidæ*, the sting, the distinguishing feature of the *aculeata*, is wanting. Dr. Dewitz maintains that the sting in the *Formicidæ* is undeveloped, but Sir J. Lubbock holds, that it is "a case of retrogression contingent upon disuse" on the ground that it is "difficult to suppose that organs—so complex and yet so similar—as the stings of ants, bees and wasps should have been developed independently." He declines, however, to hazard an opinion as to whether the sting is or is not a modified ovipositor. The whole question is evidently a most difficult one to resolve, but I would note that Lubbock's argument quoted above, and which he states is, in his eyes, "conclusive" might, with the change of a few words, be used to prove that the *Termites*

* I have mentioned three papers on ants as only having come under my notice., I should however record that there is another one of old date by Dr. Jerdon. In this a certain number of species are described and named, but I have not been able to obtain it for study. Some references to it, however, which I have come across, seem to show that the manners and customs incidentally recorded therein are truly described. The descriptions, however, were very imperfect, and the types having been lost, the Doctor's species are consequently also lost.

(or white ants) are also ants; for they, too, have a social organization with modified female forms constituting 'workers' and 'soldiers.' Yet nothing can be more certain than that they (the *Termites*) belong to an Order, viz.:—the *Neuroptera* in no way allied even to the *Hymenoptera*.

The ants, like the Wasps and Bees, are social. The Queen (♀) has wings (there are exceptions) which however drop off when she has been fecundated. The Male (♂) is winged for life (with only one or two known exceptions of apterous ♂). Every species of ant (again with only one or two known exceptions) has, in addition to these, at least one other and sometimes two other forms. The 'Worker' (♀), that is, the apterous insect commonly known as the 'ant', like the ♀, has a sting (or its modification). She is in fact a ♀ in which the generative organs have totally, or partially, aborted, exactly corresponding so far with the worker bee or wasp. In some species, however, all the ♀ are not alike in form. The ♀ minor is comparatively small and, also, comparatively speaking, is normal in shape, i.e., resembles the ♀. While the ♀ major is usually a grotesque looking insect, considerably larger than the ♀ minor, with a monstrous head. Very often, as in the common large black ant of our bungalows, all the intermediate gradations between these two forms may be found in the same community. In some species, however, only the two extreme forms are represented, they are then usually known as 'Worker' (♀) and 'Soldier' respectively. Lubbock believes that this is related, in some way, to the division of labour, but I confess I have never seen any proof of this. If a road along which *Holconyrmex* is harvesting grain be watched, it will be seen that the individual ♀ vary in size from $\frac{1}{4}$ to fully $\frac{1}{2}$ of an inch in length, and the biggest by no means carry the biggest loads or work hardest. That the ♀ and soldier (♂) however have different duties is certain; for instance, the latter will never be seen carrying grain, or doing manual labour; probably it is beneath her dignity, or possibly contrary to the military regulations.

The ants resemble the wasps, and differ from the bees, in having more than one ♀ in each nest. For a very long time it was taken for granted that a ♀ did not outlive the year in which she was born, and on this misconception many theories were based. Sir J. Lubbock

however has amply proved that a ♀ not only can live 7 or 8 years, but that her fecundity remains unimpaired. The ♂ too, he has shown, lives equally long, in this, assimilating to the bees rather than the wasps, whose communities, in Europe at any rate, are annual ones.

The body of an ant consists of 3 parts.—Head, Thorax, and Abdomen. The thorax however is not joined directly to the abdomen, but is connected with it by a 'pedicle,' the shape of which is of considerable importance in classification. The antennæ in the ♀ and ♂ consist of a long shaft (1st joint) known as the 'scape,' and a 'flagellum' of from 6 to 11 short segments, the apical ones, usually, forming a sort of club. The number of segments is usually different in the ♀ and ♂. The antennæ of the latter may contain as many as 17 joints, and the first joint is usually not appreciably longer than the rest, and the club shape is wanting. The eyes of ants are compound, consisting of many facets, varying from 1 to 1,200 or 1,500. Some species, however, are quite blind. In addition to these compound eyes, ants have also ocelli, usually 3 in number, arranged in a triangle, with the apex in front, on the top of the head, though sometimes the anterior ocellus alone is present. Usually the ♂ are without ocelli, which, however, are always present in the ♀ and ♂. The pupa among the ants is sometimes naked, and sometimes enclosed in a cocoon. It has even been recorded that in the same species and even in the same community the pupa is sometimes naked and sometimes not. The abdomen, in the ♀ and ♂ consists of 6 segments, in the ♂ of 7.

Four main sub-divisions of the ants have hitherto usually been recognized:—

1. *Formicidæ*:—having one node in the pedicle, destitute of sting, pupæ naked or enclosed in a cocoon.
2. *Poneridæ*:—having one node in the pedicle, the second segment of the abdomen constricted, armed with a sting, pupæ enclosed in a cocoon.
3. *Dorylidiæ*:—pedicle and abdomen sometimes as in the *Poneridæ*, sometimes as in the *Myrmicidæ*.
4. *Myrmicidæ*:—having two nodes in the pedicle, armed with a sting, pupæ naked.

Dr. Forel, of Zürich, to whose works, and kind assistance, I am indebted for most of the technical information contained in this

paper, and especially for the identification of the species, substitutes for the *Formicidæ*, two sub-divisions, based mainly on the form of the gizzard, viz. :—

Camponotidæ:—pupæ ordinarily enclosed in a cocoon.

Dolichoderidæ:—pupæ always naked.

I may be fanciful, but I have thought that I could trace degrees, or rather phases, of 'civilization', among the ants, corresponding very fairly with the above classification. Among the *Formicidæ* we have *Prenolepis*, the gipsy without any settled home, or at any rate so little attached to it as to be ready to shift on the smallest provocation, at one end of the scale, while at the other, *Camponotus* is found in large permanent communities, keeping cattle, and living on their produce. *Ecophylla* makes a nest of leaves, joined together with a silky material, but this is the wigwam of branches of the savage, and these nests are often constructed over and round aphides, etc., and are in fact 'byres.' *Polyrachis* has pushed farthest the practise of nest-building (*spinigera* actually spins a complete bag of silk to line her subterranean nest), still they are a timid retiring folk, living from hand to mouth, on vegetable juices, and possibly on the produce of their cattle, though I have never ascertained this last. The *Poneridæ* are unequivocally in the hunting stage of civilization. Lubbock says: "Our English hunting ants generally forage alone. In warmer climates, however, they hunt in packs and even in armies." According to my experience, this is not quite correct. Among the *Poneridæ*, the social instinct is limited to domestic affairs, and to occasional predatory raids. All the species, as a rule, and *Ponera* (and perhaps others) always, forage singly. Should one of them find a prey, she will struggle with it single-handed, and even abandon it, but it will never enter her head to seek help. Indeed, I have often fancied, I noticed a movement of impatience (unfit to be recorded, I fear, even if it could be translated, and certainly unlady-like) when a stray ♀ finding a sister struggling with a prey beyond her powers has proffered assistance.* Among those species which do organize raids, such as *Lobopelta*, when a ♀ finds, not a single edible article, no matter how large, but a collection of titbits,

* Mr. Rothney tells me that this exactly accords with his experience.

which must be secured, working against time—such a find may be, for instance, a dead branch lying on the ground covered with white ant galleries, if by any chance these galleries have been broken open—then the lucky finder seizes a termite, and starts for home at a ‘wolf’s trot,’ and very shortly, a column of ants 4 or 5 abreast and several yards long is making for the spot at the double.* The *Dorylidae* are a mysterious folk, living deep in the bowels of the earth, and nocturnal in their habits. Of the manners and customs of *Dorylus* (or ‘ponerine branch’ as I may call them) I know practically nothing. *Enictus* (=myrmicine branch) is a disciplined *Lobopelta*, and bears the same relation to the *Poneridae*, as the Zulu to the ordinary African negro. No individual foraging is undertaken, all is done, as Lubbock puts it, “in armies.” The formation is usually wider than among the *Poneridae*. *Enictus*, though belonging to the ‘Myrmicine branch,’ has retained the very characteristic ponerine method of carrying the prey, beneath the thorax and abdomen, her legs straddling over it; a method unknown to the other Families.† The *Myrmicidae*, in part at least, have reached the agricultural stage. Species which carry home food they have found, in their stomachs, are comparatively the exception. The lowest in the scale would seem to habitually carry home vegetable products, though some do not seem to store them. The harvester par excellence is *Pheidole*, who is run very close however by *Holcomyrmer* and *Solenopsis*, both these latter, handicapped by their short legs, so unsuited for cross-country work, have evolved the road-making instinct (finding that course easier perhaps than evolving longer legs). *Pheidole*, nothing behind however in engineering genius, practises a system of embankment against floods, fit to make a Hollander green with envy. *Catantopus* has lagged somewhat, she seems to store no grain (though she certainly brings home vegetable products), she keeps cattle, however, in the nest. *Crematogaster*, while only exceptionally using roads and omitting altogether to store,

† That *Lobopelta* does not always follow this routine, however, is shown in an interesting Note by Mr. Atken on *L. chinensis*, which will be found farther on, and which shows them adopting pure *Dorylina* tactics.

i It is curious that, in Europe, *Polycergus*, a genus of the *Formicidae*, and the chief ‘slave dealer’, has adopted this peculiar method of transport.

food, has carried the art of nest-building to perfection. In some species at any rate, as testified to me by Mr. Aitken and by Mr. Taylor (Orissa), she still habitually keeps cattle, often enclosing them in 'hyres,' specially built over them.*

Cattle.—Ant cattle are usually *Aphidæ* or *Cocci*, some species however tend various other species of *Hemiptera*, among which may be named *Leptocentrus taurus* and *Diaphorina guttulata*. Larvæ of the *Lyccenidæ*, among the butterflies, also furnish a considerable contingent of cattle. The following ants are recorded by de Nicéville in his "Butterflies of India," as tending lycænid larvæ, viz. :—

FORMICIDÆ:—

- Camponotus rubripes* (Drury).
- Camponotus mitis* (Smith).
- Formica nigra* (??=*Camponotus* sp.).
- Ecophylla smaragdina* (Fab.).
- Prenolepis longicornis* (Latr.).
- Prenolepis clandestina* (Mayr.).
- Tapinoma melanoccephalum* (Fab.).

MYRMICIDÆ:—

- Monomorium speculare* (Mayr.).
- Monomorium latinode* (Mayr.).
- Cremastogaster Nicévillei*, MS. (Forel).
- Pheidole quadrispinosa* (Jerdon).
- Pheidole latinoda* (Roger).

Mr. de Nicéville does not say what he understands by 'tending cattle,' and though most of the above very likely do tend cattle, I can scarcely believe that *Pheidole latinoda* does so habitually. Of course any ant, even a *Ponera*, will stop to lick sugar when she comes across it.

Pets.—It is very difficult to say where the line between pets and cattle, on the one hand, and pets and fellow-lodgers, on the other,

* Though *Cremastogaster* does not store grain, I have seen *perelagans*, lie in wait for *Holcomyrma*, returning home, laden with grain, and by threats, rob her of her load, on her own private road; and this manoeuvre was executed, not by stray individuals, but by a considerable portion of the whole community. Surely this is the acme of civilization.

should be drawn. That *Aphidæ*, *Cocci*, and lycanid larvæ are distinctly cattle, there can be no doubt. But in almost every ant's nest (or to speak more correctly in the immediate neighbourhood of it) may almost always be found a crowd of *Invertebrata*. Thus one and the same stone may cover a colony of *Prenolepis longicornis*, and the entrance to the nest of a *Pheidole*, and even possibly to that of a third species, and besides this, may be found to shelter "wood-lice" (*Oniscus*), "Fish insects" (*Lepisma*), *Cheilifera*, and true insects, of widely different families, as beetles, bugs, cockroaches, crickets, &c., &c. It is impossible, as a rule, however, to say whether there is any connexion between these and the ants, and, still more so, to define the relation between them. That there is sometimes a connexion between *Lepisma* and certain species (curiously enough usually *Poneridæ*) is shown by the observations on *Anochetus*, which I have recorded further on, but even in that case, I failed to make out what the relation was. The only case of 'pets' I have met with is recorded in my notice of *Pheidole Wroughtoni*, and even in that case it remains doubtful whether these beetles (*Pausus* sp.) should not rather be regarded as cattle. The fact that beetles, of this same genus, are in other countries, also found domesticated in ant's-nests, seems to me to indicate, that they really are 'cattle', rather than mere platonic 'pets.'

The crickets found by Mr. Aitken in the nest of *Plagiolepis longipes*, would seem to be 'parasites' rather than 'pets'; they apparently lived where they were found, for their own convenience and not for the ants' pleasure.

Mimicry.—If imitation is the sincerest flattery, then the ants are in danger of having their heads turned, so widespread and marked is the imitation of them, by spiders and other insects. What, however, is the cause or object of this mimicry, I have, in no case, been able to make out. Is it a case of the 'sheep in wolf's clothing,' or the reverse? Amongst the most persistent of the ants' flatterers are the spiders. Mr. Rothney has already recorded in his paper that certain spiders take the form of *Sima rufo-nigra* (Jerd.) and *Sima nigra* (Jerd.) Besides these, I have found several specimens of a spider, which, at a short distance, is almost indistinguishable from a ♂ of *Camponotus opaciventris*, whose mode of progression by a series of

rushes and pauses he copied closely. In the neighbourhood of almost every strong colony of *Cremastogaster contenta* (Mayr), a mimicking spider may be found, moving about at a jog trot, and waving his abdomen in the air, exactly like *Cremastogaster*. Among insects, I have taken a good many specimens of a bug, which has achieved a very fair imitation of *Polyrachis spinigera* (under the same stone, with which it may often be found), even to the extent of evolving a pedicle and spines, on what, were it an ant, would be its metanotum. Curiously enough, however, these spines are apparently not alike, in any two specimens. Is it, that this bug is still waiting for one of its race to accidentally sport spines, more like those of *P. spinigera*, and thus to set the ball of evolution rolling afresh? or, is it, that the present rough copy of the spines of *spinigera*, is found sufficient to deceive, such a short-sighted, or rather, such an 'indistinctly seeing' creature, as an ant, even at the shortest distance? In life, this bug 'humps' his back in exact imitation of *Polyrachis*, and it is astonishing how the loss of this gibbous outline, after the death of the bug, detracts from its likeness to *Spinigera*, as far as the human eye is concerned. Another, rather common, species of *hemipteron* has not taken the trouble to change his shape. It is of the ordinary shape of the 'wild' bug, but, by the evolution of judicious patches of white, which are practically invisible, the remaining dark portion of his body simulates, very closely, the outline of a small ant, pedicle, and all complete. I have often collected these nuisances (after an exciting chase) for, what I hoped was, a new species of ant. The fact that, at any rate in this case, the mimicry* is only effective from above, seems distinctly to point to protective coloration. There is no accounting for tastes, yet, from the narrow human point of view, it does seem astonishing, that any creature should exist, with so depraved a taste, as to prefer this foul-smelling mouthful to an ant, even though the formic acid of the latter, might make it taste rather 'hot i' the mouth.' The only other unmistakable case of mimicry I have met is by an *Ampulex* (one of the *Aculeata*, and therefore a comparatively near relation of the ants). Mr. Rothney has recorded this mimicking insect in his paper, and I have noted my observations on it further

* Since this was written I have taken specimens of several species of *Pteromalus* which, though not imitating any special kind of ant and perfect mimics of an ideal ant.

on, in writing of *Sima rufo-nigra*, of which species it is an 'under-study.' On one occasion, with some trouble, I captured a rather peculiar-looking specimen of *Camponotus*, and, it was only on close examination, I found that my *Camponotus* had filiform antennae, over an inch long, and was, in fact, a cricket. This occasion is, however, the only time I have come across this insect, and I scarcely like to claim it as a mimic, on such meagre evidence. Finally, I must note, that certain black *Mantidae*, in their earlier stages of development, may easily be mistaken, at first sight, for a *Camponotus* ♂ minor. The resemblance is, however, only a general one, the insect retaining the normal shape of a *Mantis*, so the resemblance may be merely an accidental (!) one.

Grain, &c., harvested.—As may be supposed, the harvesting ants only bring home single grains, consequently, it is very difficult to identify the species harvested. I believe, that all kinds of grass seed are collected by one species, in one place or another. With great trouble, I have been able to trace the two principal grasses, whose seeds are commonly harvested in the Dekhan, and these, Dr. Lisbon has most kindly identified for me as *Tragus racemosus*=*Sappago aliena* (Dalz and Gibson)=*Sappago biflora* (Roxb.), and *Eleusine mucronata*. I have also seen the cultivated 'nachni' or 'nagli' (*Eleusine corocana*) being carried home. Mr. James Taylor informs me, that he has seen rice also harvested, by ants, in Orissa. The seeds are usually brought into the nest intact, there, they are husked, and the chaff brought out, and strewn round the entrance. Dr. Lisbon suggests that, perhaps, this accumulation of chaff serves as a fortification, for which purpose, as he points out, the "muricated spikelets of *Tragus* and the pointed awns of *E. mucronata* are well adapted." This is very possible for some species of ants, and, *Meranoplus bicolor* (Guér.) and *Triglyphothrix Walshi* (Forel), the entrance to whose nests are very narrow, only bring home clean grain. Curiously enough, these same species (or at any rate *Meranoplus*) harvest a small purple flower, and, in that case, they bring home the whole flower, and strew the petals round the entrance, exactly as *Pheidole*, and the others, do the chaff of the grass seed.

Slavery.—I believe our Indian ants are above anything of the sort. I can certainly say I have never been able to find the faintest

trace or indication of it. Mr. Rothney tells me, that the late Frederick Smith, specially called his attention to the possible practise of slavery, by *Myrmecosystus viaticus* (who is known to practise it elsewhere). However, Mr. Rothney wishes to record, as the result of twelve years' observation of ant habits in India, that his experience exactly agrees with mine, and that he totally failed to find any "trace of slavery among Indian ants." Similar testimony is borne by Major Yerbury and Messrs. Aitken and Taylor.

Nothing has struck me more than the activity and energy of 'our ants,' as compared with those of Europe, contrasting so strongly, as it does, with the "limpness" of the human natives of this country.

Nests.—The ants are very impatient of drought (Lubbock, Forel, and all who have studied ants in confinement, mention the difficulty of preventing evaporation, from the artificial nests). This, no doubt, influences the form and situation of the nests, adopted by them, in their natural state. The form of nest, so common in Europe, represented by a heap of pine-needles, leaves, twigs, &c., is never seen out here. The vast majority of nests, here, are subterranean, indeed, the proportion is so large that this may be said to be the normal situation. Almost all the rest are found in hollows in trees, such as those of *Catantopus*, *Sima*, some species of *Pheidole* and of *Cremastogaster*. A few species habitually fix their headquarters in leaf-blisters, galls, &c., i. e., in cavities in the living tissues of trees; these are rare, and the only *bond fide* case I can mention is the *Cardiocondyla Wroughtoni* (Forel), which lives in blisters on the leaf of the *Jambhul*.* Finally, a few species construct nests, more or less elaborate, such are *Ecophylla* and some species of *Polyrachis* (which construct nests by joining together growing leaves with some silky material) and *Cremastogaster Rogenhoferi* and *C. ebeninus*, and perhaps some other species, which build nests of a material which looks like cow-dung, but which is, probably, a sort of coarse brown paper, manufactured from vegetable tissues, and suspend them from the branches of trees, like wasps' nests. The normal situation for the nest of a species is, however, not always strictly adhered to. I have noticed that, on the Ghâts, with a heavy rainfall and abundance of

* Even this species I have found living underground.

large trees, there is a tendency, with subterranean species, to become quasi-arboreal, while in the dry, treeless country of the Eastern Dekhan, the tendency is the other way. Moreover, I thought, when I was in Thana in 1884, that I detected several cases of change of locality with the seasons, which would be easily accounted for by the very heavy rainfall of the Konkan. Unfortunately, however, I did not record any notes, so that my conjecture is of little value, except as a hint for future observers. Amongst the species which nest in the ground, there is a great difference in the form of the nest. Among the *Formicidae*, the normal plan of the nest would seem to be a main shaft (often branching near the surface to more than one opening, especially when the entrance is under a stone), which runs down obliquely, to a main chamber, which is surrounded, on the same plane, by a maze of passages, widening in places into subsidiary chambers. The depth, below the surface, of this main floor, is seldom very great. With the *Poneridae*, there is usually a maze of passages and chambers, close to the surface (at the surface when the nest is under a stone) with a main vertical shaft, going to a considerable depth, and ending in a main chamber. I have had to dig 4 feet to reach the main chamber of a nest of *Bothroponera sulcata*. I know nothing of the nesting of the *Dorylidae*; it has never been my good fortune to find a nest, but I live in hope. The nests I have heard of have always been in the foundations of a bungalow; as, for instance, the flight of δ , from the floor of his bathroom, recorded by E. H. A. Should I ever find a nest, I can only hope, it may be in some one else's bungalow, for I have got to dig that nest. With the *Myrmicidae*, the normal plan, is a vertical shaft, ending below in a main chamber, with numerous subsidiary chambers or landings (formed by the widening of the main shaft) at frequent intervals. From each of these landings, horizontal passages (1, 2, or 3) run out a short distance, and end in a chamber. The main chamber is very deep as a rule; with such a minute species as *Triglyphothrix Watschi*, I have had to dig 3 feet to reach it. I do not of course pretend to maintain that this normal plan is always strictly adhered to; on the contrary, I imagine it is the very rare exception. There are differences of taste in architecture amongst ants, no doubt, as amongst humans, and, moreover, the nature of the soil must

often make the construction, on the strictly normal plan, an impossibility.

Origin and maintenance of Communities.—The question as to how communities are formed, is a most interesting one, and its solution is not without importance. For instance, Wallace, in an argument, leans a good deal on the distribution of ants, treating them as ‘apterous insects.’ If however the ♀ can, unaided, found a colony, the argument becomes useless, for then, the ‘ant’ ceases, for his purpose, to be an ‘apterous insect.’ There would seem to be three ways in which a nest might conceivably be founded, viz.:—

1. By a colony being, in some way, cut off from the parent nest.
2. By a few (or many) ♂ joining themselves to a fecund ♀, and starting a new nest.
3. By a fecund ♀ originating a nest single-handed.

At one time, it was generally held that the 2nd was the ordinary method, that the 1st was very rare, and that the 3rd was quite exceptional, or indeed impossible. Later observations have quite upset this view.

Dr. Forel has such an interesting paper in his “*Études Myrmécologiques*,” 1884, that I cannot refrain from making a few extracts. After noting that Lubbock has discovered, and proved, the longevity of ants, which, before, were supposed to live only for one year, or less, he continues: “Another point of the greatest importance is, that Lubbock has succeeded in seeing isolated ♀ of “*M. ruginodis*, rear, single-handed, from the egg, larvæ, pupæ, and “perfect ♂ * * * Fritz Müller has arrived at the same result “for the *Termites*, in so far that, he has shown, that the king and “queen undoubtedly live several years. It is no longer necessary “therefore to hold Hüber’s opinion, viz.:—that a new fecund ♀ “required, each year, to continue the community. Hüber saw fecund ♀ “retained by the ♂, who stripped them of their wings; I have myself “seen this occur, though very rarely, with *Iasius flavus*, but never “with any other species.” After pointing out the extreme desirability of discovering how long a ♀ retains her fecundity, i. e., “her power of producing ♂ and ♀, and not merely ♂, which last, as is well known, can be produced by parthenogenesis,” he says: “We are “thus led to believe that, probably, all the individuals of a community

"are the issue of the one or more ♀, who originally founded the
 "community. The individuals of a community are not, therefore,
 "as I once thought, the lineal descendants of a foundress ♀, but
 "actually her children. This would explain how 'racial,' and even
 "'varietal,' characteristics, are so unchangingly maintained, in a com-
 "munity. It follows from this that, when the one or more ♀ of a com-
 "munity die, or lose their fecundity, through old age, the community
 "dies out also. The case of a community, formed by the separa-
 "tion of a colony from the parent nest is, therefore, exceptional, and
 "cannot extend its duration. The possibility, that wandering ♂
 "attach themselves to a fecund ♀, and assist her (as conjectured by
 "Lepoetier and myself) remains, and is admitted, even by Lubbock."
 Further, Dr. Forel, in a letter to myself, writes: "Blochmann
 "has resolved the question in a manner absolutely definitive. It is
 "the fecund ♀ sola, who founds the new nest, or at least an associa-
 "tion of fecund ♀." I confess I have always been so convinced, that
 the ordinary method was No. 2, that I have been always on the
 look out for facts, such as the observations of Mr. Taylor and Major
 Yerbury, on *Cecophylla smaragdina*, showing that it was possible
 for a ♀ sola to found a community, believing that method to be
 exceptional. Mr. Rothney, whom I have consulted, assures me
 he has always held the same view and, consequently, has never
 specially recorded any observations, showing "foundation" by the
 2nd method. However, his note on *Polyrachis larvissima*, would
 seem to show that communities are sometimes originated in this way.
 The theory that a nest never adopts a new ♀, but that the duration
 of a nest depends absolutely on the existence of the foundress ♀, as a
 producer of ♂, is strongly supported by (if it does not directly follow
 from) the abandonment of the view that the fecund ♀ is, ordinarily
 assisted by ♂ in the task of founding the nest. I would point out
 to members how valuable would be any observations, which they may
 be able to make and record bearing on this question, of the manner
 in which ant communities are founded and maintained. A nest
 formed, by scission from a parent nest, is undoubtedly exceptional,
 for a cataclysm (from an ant's point of view) of sufficient magnitude,
 to abruptly and completely stop all communication between a colony,
 and the parent nest, must be of very rare occurrence.

The senses of ants. This is a most interesting subject, and one on which a good deal has been written; but I have, so far, gleaned little that throws any light on the many vexed questions involved in it in connection with 'our' ants. I can only refer any member interested in the matter to Sir J. Lubbock's "The Senses of Animals," as containing the most easily available summary of the question. There is one point in that work, however, on which I am able to offer an 'experience.' Lubbock records that a *Mutilla* (a genus closely allied to the ants) "makes, when alarmed, a rather sharp noise by rubbing one of the abdominal rings against the other;" a similar organ has been found in the genus *Ponera*, "which, in the structure of its abdomen, nearly resembles *Mutilla*," and finally, in the 'true ants,' has been found "a similar rasp-like organ in the same situation." He adds, however, "that ants produce no sounds which are audible to us." I am almost certain, however, that I have heard such sounds. When one of the large 'brown paper' nests of *Cremastogaster Rogenhoferi* is violently, and suddenly, disturbed, the ants swarm out in thousands, 'wagging' their abdomens, in the manner so characteristic of *Cremastogaster* when excited; at such times a distinct hissing sound is audible, as if a red-hot cinder had been plunged into water. I had always accounted for this by supposing it was caused by the material of the nest under the feet of the ants, and a similar, though fainter, sound, which may be heard when a large nest of *Camponotus*, or *Polyrachis spinigera*, is disturbed, by the rubbing together of the bodies of the ants, who are all in violent movement at once. The passage from Lubbock quoted above, however, leads me to think that this is not so, but that the audible noise is the sum of the individual stridulations of countless ants. The 'tail wagging' of *Cremastogaster* would account for the sound made by them being louder, though they are so much smaller than *Camponotus* or *Polyrachis*. I had asked Mr. Aitken to make some experiments to check the results I thought I had obtained. Members will no doubt recognize his hand in the following characteristic note which fully supports my contention. "I do not need to experiment. The roar raised by a squadron of "*Lobopelta*, if you poke at them with a straw, does not require "to be listened for with your hand to your ear. I should like,

"however, to know something about the 'organs' by which it is produced. Military drums! I should think."*

The following is a catalogue of the species of ants which have come under my notice, or have been sent to me, with short notes of such manners and customs as have struck myself, or my correspondents, as worth recording. Almost all the species recorded have been identified, or named, by Dr. Forel, to whom I cannot sufficiently express my gratitude: I must record here, as a caution, however, that all these names cannot be guaranteed correct. They are sufficiently so to act as pegs, on which to hang the few notes I have collected; and I trust that Dr. Forel will, in due course, publish, in detail, the result of his final examination, in this Journal. I have decided not to delay the publication of these notes, in the hope that some member may be sufficiently interested by them, to decide to lend a hand, by collecting notes and specimens. The latter are especially wanted *now, at once*. The greater the number of specimens, from different localities, submitted for examination to Dr. Forel, the more thorough and 'pucka,' will be the results he will be able to give us, in the pages of our Journal. In view of Dr. Forel's promised papers, I have carefully avoided all technical descriptions, save only a few, fairly obvious characteristics, which I have gleaned from the works of Messrs. Mayr, Emery and Roger, and which, I hope, will enable members to make a rough guess at the genus. I offer the plates in fear and trembling; draughtsmanship has no part in my constitution, alas! If they are any way presentable, it is due to Mr. Tom Le Mesurier's artistic powers; had they been altogether his, they would certainly have been better. I must also record my obligations and thanks to my most patient teacher in myrmecology and very good friend, Dr. Forel, and to all the gentlemen who have so kindly helped me by sending me notes and specimens. May their number increase!

FORMICIDÆ.

A. CAMPONOTIDÆ.

In the *Camponotidæ*, the cloacal orifice is small, circular, apical

* Since the above was written, Dr. Forel has called my attention to the fact that he had long ago recorded that some European species of *Camponotus* make an audible noise when their nest is disturbed.

and ciliate. In the insect, seen from above, all the segments of the abdomen are visible, the fifth being conical and apical.

Gen. 1. CAMPONOTUS (Mayr).

The genus *Camponotus* may be recognized by the trapeziform epistome. It is, however, easily distinguished from the next, by the two first segments of the abdomen being sub-equal in length. There are two forms of ♀, differing immensely in size and shape, but connected by a series of intermediate forms. The genus is best represented by the large black ant, so common about our bungalows, the species of which varies with the locality. (In Northern India it seems to be replaced by another genus, viz.,—*Myrmecocystus*.) Wherever *Camponotus* is found, a search, more or less protracted, will often disclose, that she has a colony of 'cattle' somewhere. These 'cattle' are usually either lycænid larvæ or some species of homopteron. In the eastern part of the Poona District nearly every babbul tree (*Acacia Arabica*) will be found covered with *Camponotus*, the ascending individuals, sleek and black, the descending, bloated, and showing whitish rings between the segments of the monstrously distended abdomen. I have never been able to decide whether they had 'cattle' up aloft, or were extracting, directly, the vegetable juices, with which they were evidently distended. Mr. Aitken, who is a close observer, and to whom I propounded the problem, wrote to me: "I have come to the conclusion, that one of the most important sources of 'food supply,' which ants have, is the sacchariferous glands, to be found at the bases of so many leaves. The Banian (*Ficus Indica*) leaf, in January and February, has a smear of sweets, just at the junction of the leaf and its stem, which is in great request, even among parrots and squirrels (you will see the latter rushing about the tree, giving a lick to each leaf in turn). How much more ants!" I must confess that my observations corroborate this view. The marriage flight takes place, as recorded in his paper by Mr. Rothney, and by Jerdon, in June, after the first monsoon showers, usually in the evening or at night, though on cloudy, drizzling mornings, I have seen the exodus of ♀ and ♂ continue up to 8, or even 10 A. M. The genus, I believe, is normally crepuscular, and during the hot weather there is very little activity displayed, but, as soon as

the rain falls, and the skies are clouded, the whole community swarms to the surface, and ♂ may everywhere be found, seizing and carrying off the dead and dying ♂, of their own, and other species, evidently as food, so that their regimen is not always strictly limited to pastoral products. Probably, at this time of the year, their cattle are immature, and vegetable juices are not easily available. They are great wanderers, and I scarcely ever remember to have commenced digging a nest of *Pheidole*, *Holcomyrma*, or any other species, without ♂ of some species of *Camponotus* turning up apparently in a terrible hurry, and evidently attracted by the concussion, caused by the blows of my pick. When larvæ or pupæ were turned up, each individual seized on one, and made off in the same excited, hurried way, in which she arrived.

1. *C. maculatus* (Fab.) race:—*compressus* (Fab.)
 Poona Districts (♂ ♀ ♂ in June).
 Kanara.....E. H. Aitken.
 C. ProvincesJ. A. Betham.
 Salem, MadrasA. Burroughs Sharpe
 SunderbunsRobt. Ellis.
 Bengal, Madras. G. A. J. Rothney, (♀ ♂ in May and June).
 Dharmasala, Punjab.....Major Sage.
 Rai Bareilli, Oudh.....Dr. Simpson.
 Kondmals, OrissaJas. Taylor.
 Trincomalee, Ceylon.....Major Yerbury.

This is a very common species, distributed, more or less, all over India. I have often found it 'herding' *Leptocentrus taurus*. Mr. Cotes, of the Indian Museum, Calcutta, who kindly identified this bug for me, wrote: "I saw this species in Dehra Dun last year, "on the branches of a tree, attended by a lot of large black ants, "which I took to be the common *C. sylvaticus*."* I did not observe "them very carefully however. Mr. Wood-Mason also notices, that he "has seen a similar insect attended by ants in Calcutta." I have also found it tending a species of *Psyllid*, which, through the kindness of Mr. Cotes, has been identified, by M. Lethierry, as a new species of *Diaphorina*, and named, and described by him, in the Journal of

* *C. sylvaticus* (Oliv.) is a synonym of this species.

the Asiatic Society of Bengal, under the name of *guttulata*. Mr. de Nicéville records this, or a closely allied race, as tending larvæ of the following *Lycænidæ*, viz.:—1 *Chilades laius* (Cramer), 2 *Catochrysops cnejus* (Fab.), 3 *Tarucus theophrastus* (Fab.), 4 *Polyommatus balticus* (Lin.).

2. *C. maculatus* (Fab.), race:—*Taylori*, (Forel in MS.).
 Bombay.
 Coonoor, Madras R. W. Daly.
 Kondmals, Orissa.....Jas. Taylor (type).

I found a few specimens of this species, on the side of the high road, at the back of Treacher's shop, close to the University Gardens, in Bombay.

3. *C. maculatus* (Fab.) race:—*mitis* (Smith.)
 Poona Districts.
 KanaraE. H. Aitken.
 Coonoor, MadrasR. W. Daly.
 Mt. Abu, Rajputana.....F. Gleadow.
 Kondmale, Orissa.....Jas. Taylor.
 Myingyan, BurmaE. Y. Watson.
 Trincomalee, CeylonMajor Yerbury.

Not a rare species, but on the Bombay side, the next seems to be the common form. In forwarding specimens from Ceylon, Major Yerbury wrote: "In great numbers on the 'bher' trees below Fort Frederick (17-1-91 to 17-2-91). It is apparently in attendance "on a species of hemipteron.* I searched round the bher trees "for a nest, but could find none. In addition to attending on the "homoptera as above, I have seen this ant in attendance on a "coccus on a bher tree and another coccus on a jungle creeper. "On 17-1-91 I found on a bher tree a lycænid pupa from which " *Spalgis epius* ♂ emerged; there was a single ant in attendance "on it. Since then I have found three lycænid larvæ feeding on the "bher berries, but only on one occasion saw an ant in attendance. "This species of ant is therefore pastoral and attends on several "insects of diverse genera." Mr. de Nicéville found it attending "the lycænid larva of *Lampides calianus*

* The insect referred to is identical with, or very closely related to, *Leptocentrus taurus* mentioned above.

4. *C. mitis* (Smith) var. *fuscithorax* (Forel).

Poona Districts.

KanaraE. H. Aitken.

Coonoor, MadrasR. W. Daly.

Trincomalee, CeylonMajor Yerbury.

Calcutta.....G. A. J. Rothney.

This seems to be the common Bombay form of the last. It is rarely found outside the nest. It is pale coloured.

5. *C. mitis* (Smith) var. *crassinodis* (Forel in MS.).

Papun, BurmaMajor Bingham. (6-91 ♂ ♀)

Major Bingham took this variety with the winged sexes in June, 1891.

6. *C. maculatus* (Fab.) race—*dichrous* (Forel) var. *Katensis* (Forel in MS.).

Dharmasala, Punjab.....Major Sage.

Mussoori, N.W. P.G. A. J. Rothney.

This is the Indian representative of the European species *C. dichrous*, and is probably exclusively Himalayan.

7. *C. maculatus* (Fab.) race—*infuscus* (Forel in MS.).

Ceylon.....Major Yerbury (5-91 ♂).

8. *C. maculatus* (Fab.) race—*junctus* (Forel in MS.).

BarrackporeG. A. J. Rothney.

9. *C. invidus*. (Forel in MS.)

Kondmals, Orissa...Jas. Taylor.

10. *C. angusticollis* (Jerdon).

Poona6-91 ♀).

Thana Dists.F. Gleadon.

KanaraE. H. Aitken.

I have never found a nest of this species in Poona, but have taken the ♀ in June: Mr. Gleadon sent me some ♀ and one or two from Thana.

11. *C. radiatus* (Forel in MS.).

Kanara.....E. H. Aitken.

ThanaF. Gleadon.

12. *C. dorycus* (Smith). race.—*catin* (Emery).

Bombay.

I took a single specimen, in May, 1890, but I have no record of the exact locality. I have a suspicion it was in Bombay. The type, described by Emery, came from Tenasserim.

13. *C. Nicobarensis*. var: *exiguoguttatus* (Forel).

Burma.....Major Bingham and E. Y. Watson.

This seems to be a common species in Burma, but is not found I think in the Bombay Presidency. Mr. Aitken, however, some years ago, sent me a specimen from Kanara, very closely allied to this species, but has never been able to obtain any more for me.

14. *C. micans* (Nyl).

Poona Districts.

Calcutta, Bengal.....G. A. J. Rothney.

This is not a common species in India, where it is represented by the next.

15. *C. micans* (Nyl). race: *paria* (Emery).

Poona Districts.

Kanara.....E. H. Aitken.

Coonoor, Madras.....R. W. Daly.

Dharmasala, Punjab.....Major Sage.

Tunghoo, BurmaE. Y. Watson.

TravancoreH. S. Ferguson (a variety).

Calcutta; Benares; Mussoori...G. A. J. Rothney.

Madras; ColomboG. A. J. Rothney.

16. *C. micans* (Nyl). race: *rufoglaucus* (Jerd).

Ceylon.....Major Yerbury.

C. micans (Nyl). race: *dolendus* (Forel in MS.)

Dharmasala, PunjabMajor Sage.

17. *C. sericeus* (Fab). var: *opaciventris* (Mayr).

Poona Districts

Kanara.....E. H. Aitken and T. R. D. Bell.

Salem, MadrasA. Burroughs Sharpe.

TravancoreH. S. Ferguson.

Thana DistrictsF. Gledow.

Bengal.....G. A. J. Rothney (type).

Dharmasala, PunjabMajor Sage.

Kondmals, OrissaJas. Taylor.

Trincomalee, CeylonMajor Yerbury.

Madras ; ColomboG. A. J. Rothney.

A wide-spread and common species but timid and retiring. At first sight, it looks more like a *Polyrachis* than a *Camponotus*. The communities are usually small, and the ♂ do not seem to differ so much in form, as in other species, or perhaps it is that the ♂ major are rare. The nest is subterranean, and not always easy to find ; it is generally furnished with a built-up tubular entrance, rising less than an inch above the surface ; this porch is built of minute pieces of grass, worked up with mud, and, to my mind, seems to foreshadow the building genius of the next genus. Mr. Aitken writes to me of this species. " Found crossing dusty roads singly, and " apparently without object. Nest, a hole in open sandy plains ; " cannot be dug up, because the loose sand rolls down, and " obliterates everything ; the ants must plaster the inside, or line " it with silk. They bring out the sand, one grain at a time, " working in great haste. The entrance is a very small hole. " This is one of the commonest ants in Kanara, but I never saw it " carrying anything, and fancy it lives on vegetable juices, or " aphides."

18. *C. camelinus* (Smith). var : *singularis* (Smith).

Burma.....Major Bingham.

Major Bingham took this species in the Pegu Hills in April, 1889.

19. *C. Buddhas*. (Forcl in M S.)

Lahoul, ThibetMajor Sage.

Major Sage brought back a single specimen from Lahoul.

Gen. 2. *CATABORSIS* (Mayr).

In contradistinction to the trapeziform epistome of *Camponotus*, this genus has the borders of the epistome practically parallel ; it is moreover characterized by the peculiar truncate appearance of the fore part of the head, this peculiarity is especially noticeable in the ♂ major.

20. *Col. pubescens* (Mayr).

Monlmain, BurmaMajor Bingham.

Major Bingham writes : " Emits an acrid white froth when seized like *Bothropocera rufipes*."

Gen. 3. POLYRACHIS (Shuckard).

In this genus, the first segment of the abdomen is as long as all the rest together, which gives the abdomen a spherical form. There is only one form of ♂, which, moreover, varies very little in size.* All the species are more or less armed with spines. The genus is little developed on this side of India, and especially in the Dekhan, but from Burma some 20 species are recorded. The Bombay species are never found in our bungalows; they are a quiet, timid folk. Though I have frequently watched them, I have never been able to detect their source of food supply. I have noticed that even the arboreal species seem to come to the ground when foraging. The use of a spun material in the nest seems to differentiate it from *Camponotus* in India, though, I believe, this difference does not hold good all over the world, as the two genera are at present divided.

21. *P. levior* (Roger) race: *debilis* (Emery.)

Poona Districts.

Thana Districts.....F. Gleadow.

KanaraE. H. Aitken.

This is a comparatively rare species in the Dekhan, where I have only taken it twice, near the Ghâts; but in the moist Konkan, it is fairly common, as it seems to be also in Kanara. It is easily distinguishable from the other Bombay species, by its shiny, polished appearance. It is arboreal, and makes a nest by joining together two leaves, with a band of spun material, more or less adulterated with some vegetable product; both the nests I took were on fig trees (*Ficus glomerata*); and the adulterating material was composed of minute particles, or scales, of the bark. Dr. Forel is inclined to regard this as a synonym of *rastellata*. I must repeat that members must wait for a definite solution of this and similar questions until Dr. Forel's critical study of 'our ants' reaches this genus.

22. *P. levissima* (Smith).

Moulmain, Burma.....Major Bingham.

Calcutta and BarrackpurG. A. J. Rothney.

* (Here and elsewhere where this remark is made it refers to normal ♂; the ♂ of a young nest, i. e., the first born of a ♀, are nearly always undersized.)

Mr. Rothney notes: "Nest on tree trunks, formed of a papyraceous material. Swarms June 15th to July 7th. On one occasion I had a small colony started in the flap pocket of a leather bag, hanging in my verandah, at Barrackpor, where an apterous ♀, and a few ♂, took up their residence, throwing a light silky web across the open flap."

23. *P. testellata* (Latr.).

Trincomalee, CeylonMajor Yerbury.

In sending me this species, Major Yerbury wrote:—"Nest a number of leaves, span together, to form a rough cylinder, and one end stopped up." He describes this as a very active species.

24. *P. bihamata* (Drury).

BurmaMajor Bingham.

Major Bingham took this species in the Taungyin Valley in January, 1891.

25. *P. armata* (Le Guillo).

Burma.....Major Bingham.

Major Bingham wrote:—"Not uncommon; the variety with the black abdomen commoner; both varieties found on the same tree, but never in the same nest. I found, in June, in the Ataran Valley, a huge nest of the black variety, measuring 4' 3" × 2' 7" × 5½", made of papery material, against a door, in a forest rest-house."

26. *P. chalybea* (Smith).

Burma.....Major Bingham.

Taken in the Ataran Valley in February, 1890.

27. *P. bicolor* (Smith).

Ataran Valley, BurmaMajor Bingham.

Calcutta and BarrackporoG. A. J. Rothney.

Mr. Rothney writes me of this species: "Habits same as *P. thrina*."

28. *P. dives* (Smith).

Pegu Hills, Burma.....Major Bingham.

Tounghee, BurmaE. Y. Watson.

Major Bingham writes: "Not common; I found one nest, in Pegu, made round the foot of a little bush."

29. *P. argentea* (Mayr).

KanaraE. H. Aitken (6/90 ♂ ♀).
 Barrackpore, Bengal.....G. A. J. Rothney.

I have only received this species from Kanara, where it seems to be common; the habitat of the 'type' is given as Manilla. From Mr. Aitken's description, it is apparently very like *P. laevior* in its habits, and makes its nest in the same way.

30. *P. spinigera* (Mayr).

Poona Districts.....(10/90 ♂ ♀).
 Rangoon, BurmaMajor Bingham (a variety).
 Thana Districts.....F. Gleadow.
 Siwaliks, N.-W. P.H. M. Phipson.
 Calcutta, BengalG. A. J. Rothney (type).
 Mussoori, N.-W. P.G. A. J. Rothney (♂ ♀ ♂ May, 1872).
 TrincomaleeMajor Yerbury.

This species is very common in the Dekhan, indeed, in places, scarcely a stone can be turned over without exposing an existing, or deserted, nest; this is formed in a cavity in the soil (under a stone, or close alongside of it), which is lined with material resembling silk forming a bag with only one opening. The texture of this silk is fairly strong, and, with a little care, I have succeeded in digging up the bag intact. Dr. Forel suggested to me the possibility that this nest was not the work of *Polyrachis*, but the deserted dwelling of a *Mygale*, or some allied spider. I have, however, satisfied myself that this is not so. Early in June, 1890, I found in my garden, under a stone, a community of *spinigera*, who, apparently, had lately migrated, for the subterranean cavity was lined, not as usual with a web, but with a silvery varnish only. A week later, however, I found that this varnish had become the normal, pale brown, silky material. Moreover, in raising the stone, at my second visit, I tore the material which had apparently been made to adhere to the stone. I made several inspections at intervals of a week, and on each occasion I tore the material of the nest, to search for ♀ and ♂ specimens, and, on each following visit, I found the rent repaired; so that this material is clearly the handiwork of *spinigera*. *Spinigera* can, however, and does, under changed conditions, change her style

of architecture. In January, 1891, I found a small community, of which all the individuals, save the ♀, were only half the usual size; in this case, the nest was situated at the roots of a bunch of grass; it was in the shape of an inverted thimble, made of the usual silky material, and not covered in any way. Mr. Phipson brought me a nest of this species from the Sivaliks. It was formed by drawing together several living stalks of grass (or reeds), and joining them with the usual silk material, but, in this case, much mixed with bits of dry broken grass, possibly in order to give greater cohesion to the web, and thus better enable it to resist the strain, caused by the tendency of the stalk of grass to fly apart. Mr. Rothney writes: "In Calcutta and Barrackpore the nests are "formed of web-work, binding together a few twigs of a spiny "shrub. The winged sexes are to be found in the end of May." He also notes that the mimicking bng, which I have already mentioned, "also assumes arboreal habits, and can be generally found "on the trunks of trees, in company with the ♂ of this species."

31. *P. furcata* (Smith).

Salween Valley, Burma.....Major Bingham.

Major Bingham writes: "Makes a nest of papery stuff between "two leaves."

32. *P. furcata* (Smith) race: *gracilior* (Forel in MS).

Travancore.....H. S. Ferguson.

33. *P. Jerdoni* (Forel in MS).

TrincomalceMajor Yerbury.

Major Yerbury writes: "Nest a web on the trunk of a smooth- "barked tree."

34. *P. Indica* (Mayr).

Thana DistrictsF. Gleadow.

KanaraT. R. D. Bell.

I took a nest of this species in Thana in the rains of 1885. The irregularities in the bark of an old mango tree had been roofed over to form the nest. My recollection is that the material used was not the usual silk web, but a kind of mud cement: in a note made at the time I find, "looks like a termite workshop."

35. *P. thrinax* (Roger).

Kanara	E. H. Aitken.
Travancore	H. S. Ferguson.
Calcutta	G. A. J. Rothney.
Ceylon	Major Yerbury (27/5 and 13/6/90 ♂ & ♀).

Mr. Ferguson writes : " Nest in blister of leaf," but he sent no ♀, so it may not have been a true nest. Mr. Rothney describes the nest as "formed by binding together a couple of leaves with a few silky threads; contains only a few individuals, a rare species." While Mr. Aitken says: "Nest a shell of brown paper on the under-side of a leaf with three or four orifices." Finally, Major Yerbury records "several small nests on a tree in Peradeniya Gardens" (27-5-91); smaller nests in middle of underside of leaf—larger, "two leaves joined together overlapping about one-third of their lengths; substance of nest earthy."

36. *P. Sumatrensis* (Smith).

Ataran Valley, Burma.....	Major Bingham.
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37. *P. Mayri* (Roger).

Travancore.....	H. S. Ferguson.
Pegu Hills, Burma	Major Bingham.
Ceylon	Major Yerbury.

38. *P. proxima* (Roger).

Pegu Hills, Burma	Major Bingham.
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39. *P. scissa* (Roger).

Ceylon	Major Yerbury.
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Major Yerbury sent me a nest which was very small and composed almost entirely of some spun material.

40. *Polyrachis* sp.

Barrackpore	G. A. J. Rothney.
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Gen. 4. *CECOPHYLLA* (Smith).

In this genus the ♂, of which there is only one form, varies little in size; the pedicle is very long.

41. *Cec. smaragdina* (Fab.).

Poona Districts.

Kanara	E. H. Aitken.
Salem, Madras	A. Burroughs Sharpe.

Sunderbans	R. Ellis.
Travancore	H. S. Ferguson.
Thana Districts.....	F. Glendow.
Calcutta	G. A. J. Rothney.
Rai Bareilli, Oudh.....	Dr. Simpson.
Kondmals, Orissa	Jas. Taylor.
Burma.....	E. Y. Watson.
Ceylon.....	Major Yerbury.

This is the well-known vicious 'red' ant about whom Mr. Aitken has contributed such amusing papers to this Journal. The ♂ alone is red (and even she is said to be green in New Guinea); the ♀ which is much larger and stouter is pale green; while the ♂ is very small and black. Sir J. Lubbock claimed for *Cecophylla* that she had a rudimentary sting, but even this small endowment beyond her fellows has been denied, and in fact does not exist. It is certain, however, that she possesses the power of ejecting her venom to an extraordinary distance. When she attacks a human being she uses her jaws, and I never heard any one maintain that that was not enough. *Smaragdina* is found all over India, especially in the moister regions. In the Dekhan she is found only on the Ghât edge, and then only in weak communities. Her architecture has been so minutely and exactly described by Mr. Aitken that any further reference to it would be superfluous. *Smaragdina*, while fully maintaining the formicine reputation as a cattle-keeper, is undoubtedly also largely carnivorous. Many years ago my dog died, during the night, alongside my bed; in the morning his body was hidden from view by a coating of struggling ants. While he was alive he had remained unmolested, nor did they touch me, though my bed was their main thoroughfare on the way to the body. On one occasion I found a bone two inches long in a nest, and to this day cannot imagine how the ants got it there. I have heard Mr. Vidal, O.S., say that he had a young hawk eagle and a young owl killed by *Smaragdina*. Mr. Aitken writes: "I think *Cecophylla* feeds chiefly on the 'milk' of aphides and of butterfly larvæ;" and referring to the case of Mr. Vidal's pets adds, "On the other hand, I have scarcely ever found the nest of a sun-bird on this coast except on trees swarming with these ants." Writing to me of this species Mr. Taylor

says:—"About 4 years ago at Khurda I saw some leaves of some lime trees curled up. On looking, I found in one leaf a large green ant, entirely covered in with a web on all sides; she seemed to be sitting on white specks." On further search I found a second in a similar position. I saw no other ants on the tree." An exactly similar account was sent me from Ceylon by Major Yerbury together with the nest and ♀.* Mr. de Niceville has recorded the fact that this ant attends the larva of the lycænid butterfly *Lycænesthes emolus*.

Gen. 5. *PRENOLEPIS* (Mayr).

The absence of ocelli in this and the next genus differentiates them from *Acantholepis*; in all three the insertion of the antennæ is at the lower (or anterior) extremity of the antennal groove. In *Prenolepis* the knot of the petiole is quadrangular or cuneiform; there is only one form of ♂, which varies little in size. The form of the ♂ is of considerable importance in distinguishing the various species of *Prenolepis*.

42. *P. longicornis* (Latr.).

Poona Districts	(9/60 ♂ ♀).
Kanara.....	E. H. Aitken.
C. Provinces	J. A. Betham.
Burma	Major Bingham.
Sunderbans	Robt. Ellis.
Travancore	H. S. Ferguson.
Thana Districts	F. Gleadow.
Kondmals, Orissa.....	Jas. Taylor.
Upper Burma	E. Y. Watsen.
Ceylon	Major Yerbury.
Barrackpore; Madras	G. A. J. Rothney.

This small, long-legged, black ant is the bungalow ant *par excellence*, though it is also extremely common away from human habitations. As the above list shows, it is found throughout India. Herr Moens, who studied this species in Batavia, records that he found "a small *Blatta*" living with it in its nest; he speaks of it as found "more rarely in houses;" its place as "bungalow ant" being taken by *Plagiotelepis longipes* (Jerdon). Its senses are very acute, and it is always the first to find any eatables left about. E. H. A

* Since the above was written Mr. Aitken has recorded a similar experience in the pages of this Journal.

has a life-like notice of it in "Tribes on my Frontier." My experience is that this species has no very fixed habitation. Wherever dead leaves and rubbish have lodged in the fork of a tree a community of *longicornis* will almost certainly be found; I have also found it under stones, in cavities, &c., &c., and everywhere it was ready to move off to a new site, bag and baggage (or, to speak more correctly, 'larvæ and pupæ') on the smallest provocation. I have seen a whole community start off thus, deserting the nest, on the approach of an army of *Enictus*, news of which had no doubt been brought in by scouts. At Sholapore, I found it specially affecting, as a nesting place, crevices in the masonry plinths of bungalows; in such positions the entrance to the nest was always strewn with spoils of *Camponotus*; whether these represented dead carcasses brought home for food, or whether *Camponotus* had been attacked and killed, I could never discover. As E. H. A. states, *longicornis* is certainly largely carnivorous, at any rate, when sharing a bungalow with humans; but she also undoubtedly goes in for dairy produce when available. Mr. de Nicéville records her as attending larvæ of *Catochrysops pandava* (Horn.) She is too nervous and flighty, however, to make a good dairy farmer, and to me has always represented the "gipsy type" in the ant world.

43. *P. clandestina* (Mayr),

Poona Districts

Coonoor, Madras.....R. W. Daly.

CeylonMajor Yerbury.

Calcutta; ColomboG. A. J. Rothney.

I found several nests, all under stones, each containing an apterous ♀; the communities were all small ones. *Clandestina* is much stouter and less active in her movements than her cousin *longicornis*. Mr. de Nicéville records this species as tending larvæ of *Polyommatus bosticus* (Lin.).

Note.—I have taken two other species in the Poona Districts and have received several more, viz. :—

(1) Mt. Abu.....F. Gleadow.

(2) Burma.....E. Y. Watson.

(3) Ceylon.....Major Yerbury.

(4) Ceylon.....Major Yerbury.

But their definite identification has not yet been completed mainly owing to the ♂ form not having been taken.

Gen. 6. *ACROFYGA* (Roger).

Very like the next, but abdomen is pointed and general shape squatter.

44. *A. acutiventris* (Roger).

Poona Districts.

Ceylon.....Major Yerbury.

I took a single ♀ on the dinner table, but have never come across the ♂.

Gen. 7. *PLAGIOLEPIS* (Mayr).

This and the next genus are easily distinguished by their 11 jointed antennae, from *Prenolepis* whose antennae are 12 jointed (this of course refers to the ♂); moreover, in *Plagiolepis*, the knot is "flat and rounded above."

45. *Pl. longipes* (Jerdon).

Kanara.....E. H. Aitken

Moulmain, BurmaMajor Bingham.

TravancoreH. S. Ferguson.

Colombo; Calcutta.....G. A. J. Rothney.

Toung-hoo, Burma.....E. Y. Watson.

CeylonMajor Yerbury.

This is a yellow ant. I have never seen it in the Dekhan, but it is common enough in Bombay, and I have taken it in Bassain Fort. Mr. Aitken has furnished me with the following note:—"The habits of *Pl. longipes* are exactly the same as those of *Pr. longicornis*. Both species seem to be alike in being unable to 'gnaw,' hence their food must be carried home entire. If it is a corpse, they muster a party and bear it away; if it is anything sweet, they suck it and take away the juice in their stomachs, which are capable of being distended like toy balloons. In Kanara this species completely displaces *Prenolepis* as the house ant. Its nest is in holes in the wall, or roof, or under the foundations, in a box full of old bears' and hyænas' skulls, or in fact anywhere. It steals no farinaceous food, but carries off all portable sweet stuffs, and dead, or dying, animal food of any kind. It wanders about the plants in

" the garden sucking glands, *Aphides* and the larvæ of *Lycænidæ*
 " There is a large nest in the house which I examine regularly;
 " queens have been out for two months, remaining in the nest and
 " dropping their wings." Mr. Aitken also sent me some specimens
 of a cricket which he found living in the nest with *Flugiolepis*.
 These I sent to Herr Wasmann of Vienna for identification. As he
 has most kindly permitted me to make use of his reply, I cannot
 do better than record here an extract from his letter. "The
 " myrmecophilous cricket is a *Myrmecophila*, very near to *Myrm.*
 " *acervorum* (Panz.), perhaps even identical with it. The torsos,
 " legs, and antennæ of the 5 specimens seem to belong too
 " of a *Myrmecophila*, because the sexual organs are not
 " developed, at least no female ovipositor is to be seen. Male
 " of *Myrmecophila* seem to be still quite unknown. The sup-
 " posed ♂ of *Myrm. acervorum*, described in Burmeister's 'Hand-
 " buch der Entomologie' seems to have been the larva of a ♀.
 " I myself am now not quite sure, whether the ♂ of *Myrm. salamonis*,
 " described in my 'Ameisengäste von Tunisien,' is indeed a ♂ not
 " a larva; possibly it may belong as a ♂ or a larva to *Myrm. ochracea*
 " (Fish.), the ♂ of which is still unknown. According to the recent
 " essays of Brunner no ♂ of any *Myrmecophila* has yet been described;
 " the reason of this is that the ♂ cannot be distinguished exteriorly
 " from the ♀ larvæ. These are the difficulties in connection with
 " *Myrmecophila* which prevent the description of supposed new
 " species, unless the specimens are evidently ♀ adults. If Mr.
 " Aitken can find the adult ♀ of *Myrmecophila* with *Pl. longipes* or
 " with larger ants living in the neighbourhood, the question, whether
 " this *Myrmecophila* is identical with *acervorum* or new, can be set-
 " tled. It must be noticed that the larva of *Myrmecophila* sometimes
 " lives with small ants and the imago with larger ones. I found last
 " May (1891), near Mariaschein, in Bohemia, a very small *Myrmeco-*
 " *phila* (larva or ♂) in the nest of *Tetramorium caspium*, in the
 " vicinity of a nest of *Formica sanguinea* (with slaves, *fusca*) which
 " contained a considerable number of *Myrmecophila* ♀ adults and one
 " nearly adult larva (or ♂). The larvæ living in the nest of *Tetra-*
 " *morium* must have been those of *M. acervorum*, for that is the only
 " species of *Myrmecophila* found in Northern and Central Europe.

“ On the habits of *Myrmecophila acervorum* and her relation to the
 “ ants, I made observations for several months at Prag, by means of
 “ artificial nests. *Acervorum* is amicably *tolerated* by the ants; but
 “ neither *fed* nor *licked* by them, as is the case with *Claviger*, *Lome-*
 “ *chusa*, *Atemeles*, and other ‘genuine’ guests. I have often
 “ observed her cleansing the abdomen of an ant, who seemed to be
 “ pleased by this treatment just as if it came from an ant. Probably
 “ the nourishment of *Myrmecophila* consists of the excreta of the
 “ ants, or of the *Hypopus* parasites adhering to the ants.”

46. *Pl. Jerdoni* (Forel in MS).

Poona Districts.

Kanara.....E. H. Aitken.

A very minute species. I found it in February, 1890; a great number of ♂ were swarming up and down a tree, which was not in flower, and on which the leaf buds were just opening; the descending ants were returning ‘filled,’ so that there was evidently a source of food-supply at the top of the tree, but whether cattle or glands I failed to discover.

47. *Pl. exigua* (Forel in MS.)

Poona Districts.

Kanara.....E. H. Aitken.

Also a very minute species. It is not uncommon in the Dekhan; the nest is usually under a stone lying on damp ground; I found most nests below the embankments of the Nira Canal, or on the boundaries of irrigated fields. I have never seen specimens outside the nest, nor obtained much insight into their manners and customs. I noted, however, the extraordinarily large number of apterous ♀ to be found in the nests; in some cases they were almost as numerous as the ♂, and this, especially, in the stronger communities.

Gen. 8. *ACANTHOLEFIS* (Mayr).

The presence of ocelli in ♂ of this genus has already been noted; they are also furnished with a pair of spines on the metathorax and another on the node of the pedicel.

48. *Ac. Frauenfeldi* (Mayr).

Mt. Abu, RajpootanaF. Gleadow.
 Rai Bareilli, OudhDr. Simpson.
 CalcuttaG. A. J. Rothney (2 varieties).

49. *Ac. Frauenfeldi* (Mayr) race: *bipartita* (Smith).

Poona Districts
 Thana DistrictsF. Gleadow.
 C. ProvincesJ. A. Betham.
 Dharmasala, PunjabMajor Sage.

This is a very common ant in the Dekhan, and seems to be distributed without much variation all over India; it is met in the same, or almost the same, form, in Egypt, and along the shores of the Mediterranean. The thorax is very narrow, which makes the abdomen look disproportionately large; this latter has a silky look, which takes away from its jet-black colour; the thorax is reddish. It is usually found in large communities, under stones, without any underground nest to speak of. There is always a large number of fertile ♀, I have counted as many as 20; they are curiously banded with black. Though not quite so unsettled as *Pr. longicornis*, they do not seem to be strongly attached to their home, and change their quarters on small provocation. In this species I have seen the nearest, and indeed the only, approach to the harvesting of the *Myrmicidæ*; though the harvesting was of the most rudimentary character, it is curious to note that this nest was abnormally placed in a burrow in the open.

50. *Ac. Capensis* (Mayr).

Poona Districts.
 Mussoori, N.-W. P.....G. A. J. Rothney.

I found only a few stray individuals and failed to trace the nest.

51. *Ac. opaca* (Forel in MS.)

Poona Districts.....
 Goa.....E. H. Aitken.

Gen. 9. FORMICA (Linn.).

This genus has the second, third, fourth, and fifth joints of the antennæ as long, or longer, than any of the succeeding ones (except

the last); the knot is large and vertical; the ocelli are distinctly visible. *Formica*, in India, is, I believe, exclusively limited to the Himalayan region.

52. *F. fusca* (Lin.).

Kashmir.....H. Littledale.

LahoulMajor Sage.

Mr. Littledale of Baroda sent me, with the specimens of this ant, the following note:—"May 4th, 1890. Took a nest of small black ants " in Ruppeli Nala, on the south side of Nanga Parbut, at 12,500 " feet elevation, on a slope above the second glacier. The bigger " ants (*i. e.*, ♂ major) bit severely. Nanga Parbut is an immense " mountain 26,629 feet high. These ants are common on it. The " place where I got the ants was only cleared of its winter snow " two days ago, and the ants, the smaller ones especially, were " running all over the stones, and round the nest." This is the species which in Europe is so commonly kept as slaves by its cousin *F. sanguinea*.

53. *F. sanguinea* (Latr.).

54. *F. fusco-gagates* (Forel.).

55. *F. gagates* (Latr.).

56. *F. rufibarbis* (Fab.).

57. *F. rufibarbis* (Fab.), race *clara*: (Forel).

58. *F. truncicola* (Nyl.).

These seven species (only a ♀ of *truncicola*) were taken by Major Sage during a couple of months' holiday trip to Lahoul; they are all European forms.

Gen. 10. *MYRMECYSTUS* (Wesmael).

The parallel frontal ridges, and compressed abdomen, distinguish this genus from *Formica*.

59. *M. viaticus* (Fab.).

Benares; Allahabad; Agra; }
Delhi; Lahore; Tirhoot..... } G. A. J. Rothney.

Rai Bareilly, Oudh.....Dr. Simpson.

Mr. Rothney notes: "Winged sexes in May from Tirhoot; the " nearest point to Calcutta that I have taken this ant is Assensole, " where, when the train stops, it may be seen marching about the

"platform; it is not to be found so low down as Burdwan, and I have not found it at Lucknow. The late Frederick Smith suspected this ant of practising slavery; but, though it certainly does send out scouting parties, of twenty or so strong, which cover the ground at the double, I have never detected any evidence of slavery." This form is found unchanged in Europe and on the African coast of the Mediterranean.

B. DOLICHODERIDÆ.

In this group the cloacal orifice is large, linear, transverse inferior, and non-ciliate. Seen from above, only 4 segments of the abdomen are visible, the last is hidden from view below the penultimate.

Gen. 11. TECHNOMYRMEX (Mayr).

In this genus the apical segment of the abdomen can be seen looking from above; it is the only exception to the rule.

60. *Tech. albipes* (Smith).

Poona Districts.

Ceylon.....Major Yerbury.

I have only met this species once, viz., at Khandala. It was swarming up and down a tree, to and from some food at the top; what this food was I could not discover.

61. *Tech. bruneipes* (Mayr).

Coonoor, Madras.....R. W. Daly.

Ceylon.....Major Yerbury.

Gen. 12. BOTHRIOMYRMEX (Emery).

The knot is thin and distinctly inclined forward; the first segment of the abdomen is slightly produced towards the petiole—♂ ♀ ♂ are all the same size.

62. *Both. Wroughtoni* (Forel in MS.).

Poona Districts.

I have only found this microscopic species once, the nest was in a gall on a leaf of Karanj (*Pongamia glabra*); there were more than a score of individuals in the community, yet the gall was scarcely as large as a pea.

63. *Both. meridionalis*.

Poona Districts(6-12-91 ♂ ♀).

Coonoor, Madras.....R. W. Daly.

This species, though sensibly larger than the last, is also very minute. I have taken it several times and it would not seem to be a rare species. On the 12th December, 1891, under a stone, I found a large community, including an immense number of ♀ and ♂. On removing the stone a strong smell of roses was emitted, but so mixed with formic acid that, leaning over the nest, I was nearly blinded, and had to pause several times, in the work of collecting specimens, to dry my streaming eyes. The rose smell disappeared from my hands very quickly, leaving only a pungent, acrid odour which it required considerable washing to remove.

Gen. 13. *IRIDOMYRMEX* (Mayr).

The antennæ are very slightly clavate, and are only very little thicker at the apex than at the base; excluding the scape, the second joint is the longest, and the following ones decrease in length up to the penultimate, than which the terminal joint is rather longer. The ♀ and ♂ are of the same size, the ♀ is much larger.

64. *Irid. glaber* (Mayr).

Poona Districts.

Kanara.....T. R. D. Bell.

I only once took two straying specimens; but Mr. Bell sent me a whole community, including ♀ and ♂.

65. *Irid. excisus* (Mayr).

Benares; CalcuttaG. A. J. Rothney.

Kondmals, Orissa.....Jas. Taylor.

Myingyan, BurmaE. Y. Watson.

Gen. 14. *TAPINOMA* (Foerster).

The knot is flat and quadrangular; the abdomen much widened anteriorly and covering the petiole by its prolongation forward. The ♀ and ♂ are of the same size, and only slightly larger than the ♀.

66. *Tap. melanocephalum* (Fabr.).

Poona Districts.....(11-3-90 ♂).

KanaraE. H. Aitken.

Thana.....	F. Gleadow.
Orissa.....	Jas. Taylor.
Ceylon	Major Yerbury.
Calcutta	G. A. J. Rothney.

This is a minute species, but is very easily recognised by the characteristic black head, which, even to the naked eye, contrasts strongly with the almost colourless, semi-transparent abdomen. It is very common in the Dekhan, and may be found, in ascending and descending lines, on almost every flowering tree; it is specially fond of the Waras (*Bignonia quadrilocularis*). On one occasion I found a number of ♂ visiting temporary chambers (they were certainly not permanent nests) underground, at the roots of grass plants; and I found also aphides on the grass roots in these chambers. Mr. de Nicéville records it as tending the larvæ of *Zizera lysimon* (Hübner), and *Polyommatus beticus* (Lin.). Mr. Aitken notes that "when this ant is crushed it emits a very offensive odour." The nest, which is usually under a stone, when uncovered, gives out a strong odour rendered pungent by the admixture of formic acid.

67. *Tap. minutum* (Mayr).

Poona Districts.

A very minute species. I found a community in a gall on the Saundar (*Prosopis spicigera*).

Gen. 15. *DOLICHODERUS* (Lin.).

Metanotum cubic, armed with two 'teeth' at the posterior corners of the dorsal surface; knot thick, cuneiform, strongly inclined forward.

68. *Dol. bituberculatus* (Mayr).

Mergui, Burma.....Major Bingham.

69. *Dol. sulcaticeps* (Mayr).

Burma

Major Bingham writes: "I found this species, in evergreen forest "walking in a long chain, from a hole at the foot of a tree to a "bush near by, on which were a mass of white aphides. I caught "specimen after specimen, with my fingers, and found that they "emitted a strong smell of tube-roses, which hung about my fingers "for the whole day."

70. *Dol. Fœæ* (Emery).
 Salween Hills (3,000 ft.), Burma.....Major Bingham.
71. *Dol. Fœæ* (Emery) race: *fuscus* (Emery).
 Salween Hills (3,000 ft.), Burma.....Major Bingham.
72. *Dol. gracilipes* (Mayr).
 Bombay.....E. H. Aitken.
 Calcutta.....G. A. J. Rothney (20-7-85 ♂).

A nest was sent me by Mr. Aitken in 1885. They seem to depend for food on the white woolly 'coccus' (?) so common in the Konkan; where this occurs they draw the leaves together and form a 'nest.'

PONERIDÆ.

Gen. 16. ODONTOMACHUS (Lin.).

The extraordinary, bent, three-pronged jaws differentiate this and the following genus so clearly from all other *Poneridæ* that it has been proposed to promote them to a sub-family of their own. In *Odontomachus* the knot is armed with a spine at its apex.

73. *Od. rixosus* (Smith).
 Tavoy Plateau (4,000 ft.), Burma.....Major Bingham.
74. *Od. hæmatodes* (Lin.).
 Travancore.....H. S. Ferguson.
 Ceylon.....Major Yerbury.
 Madras; ColomboG. A. J. Rothney.

I asked Mr. Ferguson as to the jumping powers of *Odontomachus* and he wrote: "I got some of those which you said were supposed to jump. I don't think they do, but they can shoot themselves backwards by bending their heads, pressing their mandibles against any firm support, and then bringing them together with a click. I tried them several times, and found that if held by a prelimb, they always release themselves in this way, using the imprisoned limb as a fulcrum for the mandibles to work against."

Gen. 17. ANOCHETUS (Mayr).

In *Anochetus* the knot is unarmed. Both these genera are said to be able to jump.

75. *An. punctiventris* (Mayr).

Calcutta; Nuddea, Bengal.....G. A. J. Rothney (type).

76. *An. punctiventris* (Mayr) race: *Punensis* (Forel in MS.)

Poona Districts.

This is probably the Dekhan form. At a first glance it resembles a *Cremastogaster*, and I must confess I collected it as such, on the only occasion on which I met it. I did not notice its jumping powers, but, looking back, with knowledge gained too late, I have more than a strong suspicion that it used those powers; that, at any rate, is the only explanation which occurs to me of the marvellous way in which the crowd of individuals, from among which I was collecting specimens, seemed to melt away, before I had got half as many as I required.

77. *An. Sedilottii* (Emery) race: *Indicus* (Forel in MS.)

Poona District 19-6-90 ♀.

I found my first nest in June, 1890; it contained a winged ♀. The ♂ were engaged in long foraging rambles, from which each returned laden with a *Lepisma*, about her own length (say $\frac{1}{2}$ an inch) carried in the way so characteristic of the Indian *Poneridæ*. The *Lepisma* was in no case dead, or apparently injured, so that the reason for its capture is doubtful. I could find none in the nest when I dug it up, but as I had to perform this operation with a penknife I may easily have overlooked them even had they been there. However, I have since seen *Indicus* bringing home termites in the same way, so that I fear the rape of *Lepisma* was due to no more romantic cause than hunger. I have tried every means I could think of to make this species jump, but in vain. On one occasion only one crawled on the forceps I was using and threw itself off. As a jump it was a most insignificant performance, nevertheless it was distinctly something more than a fall. Since receiving Mr. Ferguson's interesting note on the jumping of *O. hamatodes*, however, I have succeeded easily in making *Anochetus* 'spring' in much the same way; the species is too small to enable the *modus saltandi* to be distinctly seen, but the action is distinctly that of a 'skip-jack' beetle and not that of a grasshopper.

78 *An. Tayleri* (Forel in M S.)

Kondmals, Orissa.....Jas. Taylor (type).

Writing of its jumping powers, Mr. Taylor says:—"I do not believe this ant can jump. When held a short distance from any object upon which she wished to get, she could not do so unless her front legs could reach, but fell to the ground in the attempt. I tried over and over again with several specimens, always with the same result."

79. *An. Yerburyi* (Forel in MS.)

Ceylon.....Major Yerbury (type).

Gen. 18. ODONTOPONERA (Mayr).

Knot compressed posteriorly; pro- and mesonotum 'toothed'; claws simple; second and third joints of antennæ equal.

80. *Odont. denticulata*.

Myingyan, Burma.....E. Y. Watson.

Gen. 19. BOTHROPONERA (Mayr.)

Knot cubico-globular; claws simple; second and third segments of antennæ sub-equal, last twice as long as the penultimate.

81. *B. sulcata* (Mayr).

Poona District.....(6-11-89 ♂).

Kanara.....E. H. Aitken.

Salem, MadrasA. Burroughs Sharpe.

TravancoreH. S. Ferguson.

Thana DistrictsF. Gleadow.

Kondmals, OrissaJas. Taylor.

MadrasG. A. J. Rothney.

This is a very common species. The nest is always under a stone, but usually reaches a considerable depth underground. Solitary individuals may constantly be found roaming apparently aimlessly among the grass, or carrying home prey (a dead beetle or what not) in the usual ponerine way. Their sense of locality seems feeble, and they behave exactly as libellously predicated of ants in general by Mark Twain. The probable explanation is that the *Poneridæ* are normally nocturnal in their habits; the best provided have fewer facets in their eyes than other ants, while the ♂ of some European

species, at any rate, are known to be blind. Their sting is most powerful and quite as painful as that of a bee or wasp.

82. *B. tessarinoda* (Mayr).

Kanara.....E. H. Aitken.

OrissaJas. Taylor.

CalcuttaG. A. J. Rothney.

83. *B. rubiginosa* (Mayr).

Poona Districts.

I found a large community near Lanowli, but failed to reach the main chamber of the nest, which was very deep down underground. I saw no individuals outside the nest. This is a transition species and might perhaps be better classed with *Ponera*.

84. *B. luteipes* (Mayr).

Coonoor, MadrasR. W. Daly.

Dharmasala, Punjab.....Capt. Fulton.

Mussouri, N-W.P.G. A. J. Rothney.

85. *B. rufipes* (Jerdon).

Kanara.....E. H. Aitken; G. D. Bell.

BurmaMajor Bingham; E. Y. Watson.

OrissaJas. Taylor.

I have never seen this species in the Dekhan. The specimens sent me have only been one, or, at most, two at a time, whence I conclude that it is solitary in its foraging, like *sulcata*. Major Bingham notes: "Blows a whitish, acrid smelling, rather gelatinous froth when seized;" and this is confirmed by Mr. Taylor, who writes: "When irritated exudes a milky substance of a frothy nature which hardens on exposure to the air and resembles fine cotton; it is called 'demon chunti' or 'gendu,' the 'demonas' being the weaver caste in Orissa."

Gen. 20. *DIACAMMA* (Mayr).

Knot almost spherical, flat behind, bidentate; claws simple, second joint of antennæ twice as long as the third.

86. *D. vagans* (Smith).

Pegu, Burma.....Major Bingham.

Calcutta; Madras.....G. A. J. Rothney.

Mr. Rothney in his paper on Indian Ants, reprinted in this Journal,

writes very fully of this species. He declares it to be, viewed individually, the most intolligent of all the ants.

87. *D. scalpratum* (Smith).

Tenasserim.....Major Bingham.

Major Bingham describes it as "very common; makes a big ant heap in paddy fields; stings and bites virulently."

88. *Diacamma* sp.

Travancore.....H. S. Ferguson.

The identity of this species has not yet been definitely settled; but it is believed to be undescribed.

89. *D. versicolor* (Smith).

Barrackpore.....G. A. J. Rothney.

Gen. 21. *PONERA* (Linn.).

Knot transverse, vertical, unarmed; claws simple; second joint of antennæ longer than the third.

90. *P. Jerdoni* (Forel in M S.).

Poona Districts.

Calcutta.....G. A. J. Rothney.

The only nest of this species I have ever found was under a stone and very shallow, the main chamber being barely three inches below the surface.

91. *P. Gleadowi* (Forel in MS.).

Poona Districts.

This is not an uncommon species in the Dekhan, but owing to its small size and sluggish movements, is easily overlooked. I have found it several times, always under stones on very moist ground. Mr. Aitken sent me a variety from Kanara.

92. *P. truncata* (Smith).

Calcutta.....G. A. J. Rothney.

Gen. 22. *HARPEGNATHUS* (Jerdon).

The monstrous mandibles of this genus render it recognizable at a glance from any other ant. Whatever doubts there may be, as to the jumping powers of *Odontomachus* and *Anochetus*, I, at least, have none, as to those of *Harpegnathus*. The single specimen of the genus, which I have had the luck to find, made leaps of a foot or 18 inches with perfect ease, exactly like a grasshopper. I had

much trouble in securing this specimen, and, when I succeeded, I found she could sting better than she could jump.

93. *H. cruentatus* (Smith).

Poona Ghats.

CanaraH. G. Palliser.

Orissa.....Jas. Taylor.

In each case a single specimen only was taken. There is also a specimen in the Society's Collection labelled Matheran. *H. cruentatus* is nearly an inch long with very long legs.

Gen. 23. *LOBOPELTA* (Mayr).

Tarsal claws pectinate.

94. *L. distinguenda* (Emery).

Poona Districts.

Kanara.....E. H. Aitken.

TravancoreH. S. Ferguson.

OrissaJas. Taylor.

CeylonMajor Yerbury.

CalcuttaG. A. J. Rothney.

This species is fairly common from Poona westwards to the Ghats. The idea of a disciplined army has been fairly developed in this genus. *L. distinguenda* may sometimes, it is true, be found loafing about singly, but these individuals are probably only scouts; ordinarily, she is only met, in the early morning or late in the afternoon, travelling in an unbroken column 4 to 6 or 8 abreast, straight, or rather by the easiest road, to the scene of operations. This is usually a colony of white ants whose galleries have been broken open by the hoof of a passing beast, or some similar accident. Arrived at destination, each ♀ seizes her termite prey, tucks it under her thorax in the orthodox ponerine fashion, and the column then returns (but marching 'at ease' and much less regularly than on the outward journey) to the nest. I have never succeeded in finding a nest; on one occasion I tracked a column for more than 50 paces, only to lose it in a patch of prickly pear. I do not think that *L. distinguenda*, any more than any other ant, ever has the inspiration to open a termite gallery for herself; on the occasion mentioned above, the column passed close to several, and even over one colony of white ants before reaching its destination; I believe, however, I

saw a ♂ break open a piece of tunnel, into which a termite had retreated, but cannot be sure, and the practice certainly was not general. Nor are the termites followed into the galleries, partly, perhaps, because the passage is too small for a *Lobopelta*, but equally, I imagine, because such a measure would be very like 'drawing' a badger 'only more so.' Mr. Aitken tells me he has seen "hundreds going into a hole in the ground and emerging with white ants," but this is very different from entering a termite gallery.

95. *L. Chinensis* (Mayr).

Poona Districts (18/10/90 ♂).

Kanara.....E. H. Aitken.

Mt. AbuF. Glendew.

CalcuttaG. A. J. Rothuey.

Orissa.Jas. Taylor. (2/9/90 ♂).

This species is even commoner than the last. *Distinguenda* would seem to be a denizen of forests, while *Chinensis* prefers more open and inhabited country. I have only once seen *Chinensis* on the war-path, and then the objective, a large worm, in several pieces, had been reached, and the column was on its way home. The column I must say was more a mob than a disciplined army, but this may have been due to the fact, that the normal irregularity of the homeward march was enhanced by the size and shape of the booty, which did not admit of its being carried 'according to the regulations.' On the other hand, I have often, during the early part of the rains, witnessed a migration (or was it a colonization, in no case was a ♀, even apterous, present?), when the discipline and regularity of the column left nothing to be desired. My experience seems to show that *Chinensis* prefers a formation in fours, at any rate when carrying her own larvæ and pupæ. Mr. Aitken has furnished me with the following most interesting note on *Chinensis*. "There is a populous community of this ant, in a hole, " in the foundations of my house, at Goa. From the nest there is a " well marked 'road,' crossing a broad gravel path, and then " ramifying all over the tennis ground. They issue after sunset, " and march along one of the main branches, or break up into par- " ties and take different routes. When they come to a place where

“ the termites have thrown up new earthworks, and are busy eating
 “ the dead grass underneath, they collect in dense masses, waiting
 “ for an opportunity of breaking in, which they very likely find
 “ when the termites attempt to extend their works on any side.
 “ Then the slaughter begins. Sometimes the poor termites are killed
 “ far faster than they can be carried off; and on one occasion, as
 “ late as 7 a. m., I saw the ground still heaped with slain, and an
 “ unbroken stream of ants, 56 yards long, carrying them away.
 “ Each ant had 2 or 3 in her jaws. If these ants cross the grounds
 “ of a community of ‘ Harvesters ’ (? *Holcomyrma*) after the latter
 “ are up in the morning, they have to flee in their turn. A *Lobo-*
 “ *pelta*, when once a ♂ major has laid hold of her by the leg, appears
 “ to be perfectly helpless; she can neither kill her enemy, nor shake
 “ her off. Sometimes another *Lobopelta* will come to her assistance,
 “ and, after vainly trying to tear off the aggressor, will pick up her
 “ comrade and carry her, and her enemy, off together.”

96. *L. diminuta* (Mayr).

Mt. Abu.....	F. Gleadow (Christmas' 90 ♂).
Coonoor	R. W. Daly.
Kanara	H. G. Palliser.
Calcutta	G. A. J. Rothney.
Orissa.....	Jas. Taylor.
Tonngahoo, Burma	E. Y. Watson.
Ceylon.....	Major Yerbury.
Ataran Valley, Tenasserim ...	Major Bingham.

The specimens from Tonngahoo and Tenasserim vary slightly from the type.

97. *L. dentilobis* (Forel in MS.).

Coonoor, Madras	R. W. Daly.
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98. *L. Yerburyi* (Forel in MS.).

Hot Wells, Trincomaleo.....	Major Yerbury.
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99. *L. punctiventris* (Mayr).

Calcutta.....	G. A. J. Rothney (type).
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100. *L. Kitteli* (Mayr).

Calcutta.....	G. A. J. Rothney.
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Gen. 24. LIOPONERA (Mayr).

The joints of the antennæ (except the scape) very short; thicker than long.

101. *L. longitarsus* (Mayr).

Poona Districts. ♂.

Thana Districts ♂.

Calcutta; Nuddea.....G. A. J. Rothney ♀ (type).

Orissa.....Jas. Taylor ♀ ♂.

The ♂ comes freely to a light, at night; all through the rains, I have never taken the ♀.

Gen. 25. AMBLYOPONE (Erichson).

The knot soldered to the abdomen along its whole depth.

102. *Amblyopone* sp.

Poona Districts ♂.

This species comes freely to a light; but I have not been able to obtain the ♀.

103. *Amblyopone* sp.

Kanara.....T. R. D. Bell.

Mr. Bell sent me some specimens of what will probably prove a new species; but its identity is not yet definitely settled.

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4. Do. do. of abdomen.
5. Do. Antenna.
6. *Camp. compressus* (Fab.) ♀ minor × 9.
7. Do. ♀ maj., profile.
8. Do. ♀ min., antenna.
9. Do. ♀ maj., head × 9.
10. *Pol. spinigera* (Mayr.) ♀ × 9.
11. Do. profile.
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13. Do. antenna.
14. *Pren. longicornis* (Latr.) ♀ × 9.

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17. *Acanth. Frauenfeldii* (Mayr) r. *bipartita* (Smith) $\varphi \times 9$.
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PLATE B.

1. *Ecoph. smaragdina* (Fab.) $\varphi \times 9$.
2. Do. profile.
3. Do. antenna $\times 18$.
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9. Do. Part of leg and tarsal claws $\times 18$.
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12. Do.
13. Do. head $\times 18$.
14. Do. antenna $\times 18$.
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17. Do. node of pedicel from above.
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26. Do. do. profile.

Note.—In plate B, fig. 10, the division between segments 1 and 2 of the flagellum has been omitted.)

(To be continued.)

THE POISONOUS PLANTS OF BOMBAY.

BY

SURGEON-MAJOR K. R. KIRTIKAR, I. M. S.

(*With Plates A. and B.*)

(*Read before the Bombay Natural History Society on 5th April, 1892.*)

WHEN four years ago Brigade-Surgeon Lieutenant-Colonel I. B. Lyon did me the honour of asking me to supply him with a few concise notes on the Botanical Characters of Indian Poisonous Plants, which he has embodied in one of the Miscellaneous Appendices of his deservedly successful work on Indian Medical Jurisprudence, I thought if an independent series of accurate, well drawn, and properly coloured illustrations were placed into the hands of persons interested in the study of the poisonous plants of Bombay, it would be a great help towards the ready identification of such plants. Such a series would serve as a companion to Dr. Lyon's work, which is now extensively read all over the Presidency, without attempting to rival it or mar its usefulness. It would, moreover, I thought, enable me to add a few useful hints regarding the plants which I could not then do from the nature of the work assigned to me by Dr. Lyon, and from the necessarily limited space placed by him at my disposal.

Having been engaged for some years past in getting up the illustrations of some of the most typical and useful forest and garden plants commonly seen in and around Bombay and Thana, and happening to have in my possession the illustrations of some of our poisonous plants drawn at my request and under my personal supervision by Mr. Isaac Benjamin, I broached the subject of publishing some of them in the Society's Journal to our energetic Secretary, and placed at his disposal my illustrations, offering at the same time to write the letter-press. Mr. Phipson, with the promptness which marks everything he does, whether in connection with the Natural History Society or any other Institution, at once accepted my offer, and promised to supplement my illustrations with a few more drawn by Mr. Benjamin expressly for this series, under my supervision. My original pictures are all of the natural size. Most of them, therefore, have to appear as reduced copies of the original to suit the size of the Journal. In each case, however, at the foot of each illustration a

note will be added as to what extent the natural size has been reduced. Of Mr. Benjamin's work, I can safely say that, apart from their artistic finish, the specimens depicted are accurate and can be depended upon for the details of their botanical characteristics. They are in every instance copied from nature in their fresh condition, and in each case every attempt is made to secure a typical specimen as far as available.

"What is a poisonous plant?"—it will be asked. It is as difficult for a Botanist to answer this question as it is for a Medico-Jurist to define "a poison" in works on Medical Jurisprudence. Not even does the Indian Penal Code attempt to define "a poison," be it of vegetable, animal, mineral, or any other origin. Beck, one of the earliest of the standard writers on Medical Jurisprudence, quotes the definition given by Foderé, which, as the former rightly observes, is probably as unexceptionable as any that has yet been attempted. It runs thus:—"Poisons are substances which are known by physicians as capable of altering or destroying in a majority of cases some or all the functions necessary to life." This brief definition may be further illustrated in the words of Dr. Francis Ogston, so as to restrict the term to "such substances as when exhibited in certain quantities to healthy and ordinarily constituted individuals are capable of producing injurious or fatal effects in a more or less direct and certain way, unless where specially and specifically counteracted." Plants exhibiting such qualities may be looked upon as poisonous. The poison or noxious element may consist of an alkaloid or active principle and may exist in any or all the different parts of the organs of nutrition, *viz.* :—root, stem and leaves or their appendages, such as hairs, glands, &c., or in the different parts of the organs of reproduction, *viz.* :—flower, fruit and seeds. Poisonous plants are more or less speedy in their action, but they may not affect all alike or with equal severity. Their effects vary in an individual under different circumstances. Thus, for instance, the empty or loaded condition of the stomach materially modifies the injurious effects of a poison. The latter state even annihilates the toxic or irritant effects of some poisonous plants. Habit, again, manifestly affects the deleterious effects of poisons. The ganjah-smokers or bhâng-drinkers, who respectively indulge in their pipe of the flowering tops of *Cannabis*

Indica (Indian hemp) or a cold infusion of its leaves, may not suffer anything more than a mere temporary excitement or inebriation which may pass off without remedy. The same quantity, however, may in the novice or uninitiate produce double-vision, profound narcosis and even death by coma. This illustrates the popular adage that "what is one man's food may be another's poison." This will also explain why I have in the present series tried to illustrate plants and include them among the poisonous, such as have not hitherto been included in the noxious category, nor indeed are even suspected as being possessed of deleterious properties. "Forewarned is forearmed." In describing poisonous plants, therefore, it will be my endeavour to embody in this series, not only such plants as have been reputed poisonous from time immemorial, but also those which, within my experience, have struck me as having proved deleterious sometimes to some individuals, although used harmlessly by others.

To District Officers, and particularly to those on whom devolve the magisterial duties of trying cases of clandestine poisoning, and to Medical Officers on whom lies the sole responsibility of identifying and naming the poisonous plants, and thus occasionally helping in the cause of the administration of justice, it is to be hoped that these illustrations may be of some use in a country, the vegetation of which is essentially different from that of the land of their birth and education.

I am conscious that the illustrations fall far short of what they might be, though, as I have already said, every attempt has been made to secure accuracy. What merit or artistic beauty they possess is entirely due to the facile pencil of Mr. Benjamin, who has been my valued collaborateur in my illustrations of the Bombay Flora, Phanerogamic and Cryptogamic, and whose eye to details is as trustworthy as it is capable of delineating a charming copy true to nature.

No attempt is made to describe the plants according to their natural orders. Nor indeed is there any order as regards their appearance in this Journal. The plants are depicted just as I came across them, regardless of their virulence or severity of action on the human frame. But each plant as it appears here will be accompanied with a letter-press giving a detailed description of the plant, to enable the reader to identify it.

It may perhaps be useful to explain how vegetable poisons act. Their action is either local or remote. When they act locally as, for instance, on the skin or stomach, they irritate the parts *direct*; they are therefore called *Irritants*. The irritation may or may not be followed by inflammation. Their action in this respect is sometimes purely mechanical as, for instance, in the irritation produced by the rigid brown hairs covering the sigmoid rods of *Mucuna pruriens* (cowhage). When poisons act remotely they do so either through the nervous system and are hence called *Neurotic*; or through the heart and are hence called *Cardiac*. Cardiac poisons distinctly affect the heart in the first instance, and cause death by a sudden or gradual failure of its action. Neurotic poisons either affect the brain or the spinal cord singly, or both together. In the first case the poisons are known as *Cerebral*, and produce delirium or torpor which goes under the name of Narcotism, the poisons themselves being termed *narcotics*; in the second case, where the poisons affect the spinal cord they are called *spinal poisons*. They cause increase or decrease or total loss of sensation or motion in parts supplied by the nerves issuing from the spinal cord; thirdly, when the neurotic poisons act on the brain and spinal cord jointly they are called *Cerebro-spinal poisons*. In them we find a combination of the symptoms of both the cerebral and spinal poisons. I am not aware of any vegetable poison acting as what is called a *Septic* poison, *i.e.*, producing death by destroying the vitality of blood as is the case in colubrine or viperine poisoning.

STROBILANTHES CALLOSUS—(Nees.)

MARATHI—KÂRAVI (कादवी.)

(Natural Order—ACANTHACEÆ.)

DESCRIPTION.—A shrub 6 to 8 feet.

ROOT.—Bearing buds of the future plant, which are thickly covered over with 8-10 stiff, tough imbricated scales, studded with fine white wavy woolly hairs from three to four lines in length.

STEM.—Erect, caespitose, irregularly quadrilateral, rounded off at the angles; grooved often deeply, throughout, thus marking off each of the four angles of the stem; distinctly jointed like the bamboo down to the central pith; joints bilaterally swollen above the point of juncture, varying in length from a span to a span and

a half. Surface of stem irregularly verrucose or "scabrous tubercled," as Clarke calls it; glabrous where there are no warts. The whole stem tapers gradually from the root to the growing tip, varying in thickness at the root from $\frac{1}{2}$ to 1 inch in diameter. This tapering is highly characteristic of this plant. The inner substance of the stem throughout consists of close-packed white pith which occupies over three-fourths of its diameter. The pith has an aromatic sweetish smell, not unlike the smell of some of the pith containing stems of the *Graminaceæ*. The woody portion is barely a line or two in width or thickness. The outer-bark peels off very thin on scratching, is translucent and of buff colour in the old parts of the plant, purplish or pink at the growing end. The warts do not extend to the inner bark. The inner bark, green.

BRANCHES.—Generally absent, but when given off, always arise at the joints; are seldom subdivided; bearing a pair of opposite leaves; not thicker than a goose-quill; partaking of the quadrilateral nature of the stem; verrucose; buff coloured when old; pink or purplish and downy when young and growing.

LEAVES.—Decussate, arising at the joints only; 7-10 inches long, 3-5 inches broad; crenate; scabrous and ciliated on the upper and under surfaces; "Elliptic-cuspidate"—running down into a thin long petiole, 2-3 inches long; nerves well marked especially on the under surface, whitish, and here and there covered with small warts, 8-20 pair. Odour faintly aromatic when the leaf is bruised,—some say strongly aromatic. Feel sticky when the leaves are young, from the fluid contained in the hair-cells.

SPIKES.—Axillary single or in pair, bilateral; 1-4 inches long; strobiliform. It is on account of this characteristic strobiliform arrangement of the bracts that the genus derives its name *Strobilanthes*. Inflorescence densely cymose. Peduncles 2-3 lines in length. Bracts $\frac{1}{2}$ -1 inch long, concave, glabrous, with entire margins; the lower ones elliptical or oval, tough, green, remote from each other; the lower ones tapering or orbicular, tender, beautifully pink, closer packed, imbricate. The colour of flowers, beautifully purplish-blue, tinged with pink or rosy hue. Dalzell describes the flower as being "deep blue." Nees calls it "*cerulea*." (*Vide* Wallich's *Plant. Asiat. Racior.* Part III., p. 85.) It may be noted that the colour of my

illustration is copied from nature, from a specimen growing in my own garden at Thana when in full bloom and fresh. Hooker mentions *Strobilanthes purpurea* as growing in Ceylon (*Vide* p. 183, DeCandolle's *Prodromus*, P. XI., under *Strobilanthes asperimus*.)

CALYX.—Persistent, $\frac{1}{2}$ inch long; in fruit often exceeding even an inch; deeply quinquepartite; segments or lobes often free down to the base, oblong or acuminate, tough, covered with soft hair, greenish or yellowish-white. Segments become tougher and stiffer as they grow older.

COROLLA.—Delicate, $1\frac{1}{4}$ to 2 inches long, subequally five-lobed; glabrous without; very hairy—softly so—within.

STAMENS.—Didynamous inserted on the corolla; filaments hairy downwards; anther-lobes brightyellow, two-celled; included.

PISTIL.—Glabrous, elevated on a scarlet or deep-yellow conspicuous globular disc of the size of a millet seed; style filiform, white, slightly bifid, if at all divided.

FRUIT.—A capsule two-celled, 1 inch long, $\frac{1}{2}$ inch broad; coriaceous; obovate; loculicidal; valves elastically recurved, carrying the seeds on each half of the capsule.

SEEDS.—Three or four in each half of the capsule; $\frac{1}{8}$ inch long, roundish or ovoid, covered over with fine soft down.

TESTA.—Membranaceous.

The tree flowers from June to September. The specimen I have described threw out flowers in my garden, even when very young, from July to September. The idea that this plant flowers only once in seven years is a rural myth. The stem of the plant is an article of domestic economy in rural and even town life. The stem of the plant is cut down when about 6-8 feet long for making the mud-plastered walls of our rural and town huts and homes. It takes each stem about three years to grow to that height, and in the forest it does not flower until fairly grown. The impression, therefore, prevails that it only flowers once in seven years. The fact is when once the plant has flowered, i.e., has grown sufficiently big to be cut down for economic purposes, it is cut down and sold in the bazaars as an article of commerce. The result is, until another plant grows of sufficiently large size in the same place from the same root, for mark you, the stem is

caespitose, there are no flowers in the place for a year or two or three which is the time necessary for the 6-8 ft. growth of the plant. As I have said above, the plant has flowered in my garden in the very first year of its growth.

REMARKS.—The plant I have described is known on this side of India—in the Konkan—as *Kārav* or *Kāravī* (Marathi कारव or कारवी). In Thana it grows abundantly on the hills dividing the Thana valley from the Vehār and Tālsī valleys. My description is from the outgrowth of the species common here. There is some confusion, unfortunately, but I believe not unnecessarily with regard to the scientific name that should be given to the plant which goes under the Marathi popular name of *Kāravī*. The Hon'ble Mr. Justice Birdwood designates *Kārvī* as *Strobilanthes Asperimus* in his Catalogue of Mahableshwar and Matheran plants. Brigade Surgeon Dymock—the Prince of our living Bombay, aye, Indian Botanists—calls it *Strobilanthes ciliatus*. Colonel Beddome, another well-known name in Indian Botany, designates *Kārvī* as *Strobilanthes grahamianus*.

GRAHAMIANUS.

Now when three such eminent authorities—apparently widely differing from each other—writers on Indian Botany well versed in the local Flora they have respectively studied and mastered, designate *Kārvī* in their own special way, while I, on the other hand, follow a defunct Professor from a distant Academy, some apology, some words of explanation, may be deemed necessary, and here I will tender them in all humility.

The term *Kārvī* to my native Indian mind is essentially expressive of economy. Every plant, therefore, of the genus *Strobilanthes*, whether it be *Asperimus*, *Ciliatus*, *Grahamianus*, or *Callosus* represents a species that is known among the natives of the soil as an economic plant, fit to build up their mud-plastered huts, and as such is known as *Kārvī*. What matters it then whether a Birdwood calls it *S. asperimus*, a Dymock calls it *S. ciliatus*, a Beddome calls it *S. Grahamianus*, or I, following Nees, call it *S. callosus*? It is *Kārvī* after all!—a *Strobilanthes* and nothing more. It would still appear to be necessary that I should note the distinguishing points which characterize the specimens which have been named

or described by the distinguished and accurately observant Botanists I have named—appearing as they do to differ so much, though in my estimation really not differing to any material extent.

The specimen of the species I have examined is perhaps different from the specimen the Hon'ble Mr. Justice Birdwood, or Brigade Surgeon Dymock, or Colonel Beddome may have examined, but it is generally and generically speaking *Kārvi* or *Strobilanthes* all the same. Specific differences may exist in all of them if each one is compared with the other, and what I have chiefly to point out in this contribution is that if the leaves of the *Kārvi* that I describe as *Strobilanthes Callosus* have any irritant properties or poisonous effects on the human stomach on account of its hairs or glandular appendages, Birdwood's *Strobilanthes Asperimus* Kārvi, Dymock's *Strobilanthes ciliatus* Kārvi, and Beddome's *Strobilanthes Grahamianus* may, if similarly carelessly used, produce similar effects on the human body. Let me therefore prepare my reader to note how the plant I have described differs in its minor points from that described or named by Mr. Birdwood, Dr. Dymock and Col. Beddome, respectively. Mr. Birdwood's species has hirsute joints and trichotomous petioles. The species I describe has none of these. Dr. Dymock's description of *S. ciliatus* is very much the same as that of my *S. Callosus*. But the description of *S. ciliatus* given by Nees in Wallich (Pt. III., Plant. Asiat. Rar., p. 85) whom Dr. Dymock cites as his authority, is slightly different from the description given by Dr. Dymock. The plant described by Professor Nees has "*Rami supra genicula fibroso-fimbriati*," whereas Dr. Dymock's species is "branchless." (*Vide* 2 ed., Mat. Med. of Western India, p. 592.) The flowers in Nees' specimen are described as "longitudine bractæ" "Corolla lutea (f)"—the query Nees' own, thus showing that Nees was doubtful as to whether the colour of his species was really yellow. Whereas Dymock is positive about the colour of his *S. ciliatus* being not only blue but *bright blue*.

Leaving these three Botanists aside when I pursue this subject still further and take up Hooker's standard work on the Flora of British India, another question crops up. It is this. I must humbly admit, I find some difficulty—no small one—in following the attempt made by Clarke in amalgamating Dalzell's *Strobilanthes*

Grahamianus with *Strobilanthes Callosus* (Nees). It must be apparent to every reader of Dalzell that his *Strobilanthes Grahamianus* is essentially different from *S. Callosus*. For *S. Grahamianus* has peltate hairs, whereas the hairs of *S. Callosus* are longitudinal and tapering at the free end in a sharp point, and are composed of 2-3 longitudinal cells placed end on end. This latter I have verified by personal microscopic examination. Again, Dalzell's *S. Grahamianus* has trifid peduncles; the peduncles of *S. Callosus* are solitary. *S. Grahamianus* and *S. Callosus* must therefore on close scrutiny appear to be two distinct species.

THE POISONOUS NATURE OF THE PLANT.

With regard to the poisonous nature of the plant, the announcement now made for the first time that the *plant is poisonous*, will, to not a few, if not to all, come with some surprise. But it need not be so although in the large number of the genera of the natural order *Acanthaceæ*, there are only a few plants which are known to have irritant or, broadly speaking, poisonous properties. The poisonous quality is exhibited either in the irritant juice of its leaves or in the irritating action of its surface-hairs. Thus, for instance, the leaves of the well known *Gajakarni* (गजकर्णी) *Rhinacanthus Communis* are well-known for the local irritation—often amounting to vesication—they cause in the treatment of ringworm. It is a favorite native remedy for ringworm in certain stages. The leaves of *Blopharis Edulis* similarly, which are armed with prickles,—(only an advanced stage of the hairs on the leaves of our *S. Callosus*) and the stem of which is still more prickly, Dr. Dymock says “cause redness, burning and itching” (*vide* p. 593, 2nd ed. *Mat. Med. of Western India*), when they come in contact with the body. Similarly I have found that the pounded or bruised leaves of *Strobilanthes Callosus* when taken internally as a cold infusion have sometimes caused irritation of the stomach and produced severe vomiting followed by symptoms of gastritis. The inflammation of the mucous membrane of the stomach thus produced appears to me to be due to the mechanical irritation caused by the hairs on the leaves. Any careless use therefore of the pounded leaves for medicinal purposes is fraught with danger to the mucous coat of

the stomach. The infusion should be strained through fine muslin or flannel to get rid of the hairs before use. The fresh leaves are occasionally used by the rural classes as a general tonic, antifebrile and antiperiodic remedy in malarial fevers, and also as a stomachic stimulant and purgative. These remedial uses have the sanction of Nighanta Ratnākara, which serves as a guide to many a native medical practitioner. (*Vide* Vol. III., Arka-Prakash, p. 24, Bombay edition, 1864.) It was when the fresh leaves were used for one or other of these remedial purposes that distinct symptoms of gastric irritation showed themselves, for the relief of which latter the cases came under my observation. An examination of the vomits under the microscope showed on each occasion numerous hairs embedded in mucus. It is when the leaves are quite fresh and the minute hairs stiff and erect with the liquid contents of their cells intact, that their irritative potency is most active. Beyond local irritation therefore limited to one organ only I do not suppose the plant has any other poisonous action. The amount of irritation that its leaves produce when taken in an unguarded way will, I hope, justify my including this plant among the poisonous plants of Bombay.

DESCRIPTION OF THE FIGURES IN PLATE A.

The main figure in the centre is the growing top of the plant showing the hairs on the upper and under surface of the leaves, and the decussate arrangement of the latter. The strobiliform spikes with expanded flowers above and buds below.

The first figure at the bottom from the reader's left to right is the quinquepartite stiff calyx, two of the segments of which are turned down to show the red disc over which the ovary is situated bearing the filamentous style.

The second figure is the stiffening and growing calyx as the ovary is maturing into fruit.

The third figure is the mature fruit—a capsule, still on the disc, which has changed colour.

The fourth figure is half the capsule opened out to show the seed, which is slightly pubescent. The other half of the capsule has been removed.

TRICHOSANTHES PALMATA.—(Roeb.)

Marathi "Koundal" (कौंडल).

(Natural order.—CUCURBITACEÆ).

DESCRIPTION.—A large climbing perennial herb; sometimes twisting spirally to a marked degree; a native of forests and field hedges, running over the highest trees at times: distinctly dioecious.

Root.—Inclined to be wavy or contorted.

STEM.—Angular or irregularly rounded; deeply fissured longitudinally; often as thick as a man's arm, says Dr. Dymock, and marked with parallel rows of small irregular warts on either side of each fissure; noded and jointed; each joint situated at the distance of from $1\frac{1}{2}$ to 2 or 3 inches; giving off leaves or branches at the joints only. The transverse section of a mature stem shows that the longitudinal fissures correspond to the medullary rays and include between each pair of them wedge-shaped woody and vascular bundles, studded with round or oval intercellular canals of pretty large size sufficient to admit an ordinary pin. Dymock calculates these wedge-shaped portions as seven, but I have specimens before me in which they are as many as ten. When in spring or before the rains, the plant is resting and leafless, these intercellular spaces contain air. But when the plant revives, and resumes its activity in the rains, they contain sap which continues to flow through them for some time after the rains.

THE OUTER BARK.—Is light grey or brown, warty, corky, often presenting the appearance of crocodile skin; peeling off easily in irregular bits. *Mesophloëm* deep green.

BRANCHES.—Partaking of the spiral or winding nature of the stem; minutely tuberculated; young branches full of greenish pith. Older branches contain brown pith which loses its spongy nature and hardens into a rough friable substance.

TENDRILS.—Three-oleft, oftener bifid, minutely spiral.

LEAVES.—Generally palmate, bright green, membranous; 4-8 inches long, 2-6 inches broad, 3-5 or even 7-lobed; cordate at base; scabrous upon the upper and under surfaces; upper surface more markedly scabrous, and spotted with larger hairs seated on raised circular discs, giving the leaf a characteristic appearance under the

magnifying glass. Nerves 3-5 markedly scabrous on the under-surface, having a gland or two on each nerve deeply seated. Lobes broad, sometimes entire, sometimes again lobed, and with segments narrow, linear-lanceolate. Margin slightly serrate or dentate: Lobe-divisions sometimes deep.

Petioles also having a tendency to be winding or twisted 1-2 inches long; channelled; several large glands at the apex of petiole.

Stipules single, small, axillary.

FLOWERS.—White, delicate in the female, stont in the male, fading soon after opening over-night or early morning. The plant blossoms during hot and rainy seasons, says Roxburgh, but I have seen male flowers in November and December in Thana in the Judge's garden. This Thana plant is leafless now (March), and will continue so until the next monsoons.

MALE FLOWERS.—Racemed, large, white, most delicately fringed with long white branched bifid or trifid filaments. *Racemes* axillary, longer than the leaves, solitary, with a smaller few-flowered second *Peduncles* sometimes paired, stont, 5-6 inches long. *Bracts* of the male racemes large, foliaceous, sheathing the flower from a broad base, many times larger than the very short pedicels; ovate; fringed; viscid; covered on the outside with dark green glandular spots of the size of linseed or millet seed. *Calyx* 1—1½ inch, bract-like; segments ovate, deeply toothed or serrate; tomentose. *Corolla* 4 inches in diameter, hypercrateriform, having the appearance of a flat open parasol with its fimbriae hanging down in beautiful tapers. Petals marked yellow at the base, canesato. *Filaments* triadelphous. Anthers syngenesious, very anfractuose.

FEMALE FLOWERS.—Solitary, smaller and more delicately fimbriated than the male; axillary; peduncle not so stont as in the male. Calyx-teeth of the female flower less marked. Calyx-tube in female short. Petals according to some nearly destitute of fimbriae *Corolla* smaller than that of the male.

FRUIT.—2-4 inches in diameter, globose, smooth, of the size of an ordinary orange. When ripe of a bright deep red colour replete with a dirty looking dark greenish pulp in which the seeds nestle.

SEEDS.—Numerous, oblong, compressed, irregularly triangular, obtuse-margined; $\frac{1}{8}$ inch long; according to Dr. Dymock $\frac{7}{8}$ inch long, covered with a blackish shell, and containing a sweet oily kernel.

REMARKS.—With regard to the height of this plant Clarke (in Hooker's Flora of British India, Vol. II, p. 607) puts it down as "often 30 ft." But I think Roxburgh described it more accurately when he mentioned it as a "native of forests where it runs over the highest trees." The plant may be seen trailing over hedges and branches of trees over several yards. Roxburgh designates the plant monœcious. Wight and Arnott describe the female flower as "*solitary, in the same axil as the male*" or occasionally racemose. I have not seen the male and female flowers in the same axil yet; nor on the same plant. But I should be afraid of a definite opinion in the face of such weighty authorities: I would leave other observers to note this point. "Leaves," says Wight, "*are glabrous, sometimes slightly scabrous.*" The whole plant I think is scabrous to a more or less degree, except the fruit. Observe Clarke's remark at p. 607, Vol. II. Hooker's Flora of British India:—"A *Trichosanthes* collected in Mergin by Griffith has the leaves with short hairs beneath." Variety *Trichosanthes Tomentosa* is also tomentose beneath (*Heyne in Herb Rottil*).

Clarke describes the fruit as marked with ten orange streaks. I cannot help thinking that when he wrote this he had the *Cucumis Trigonus*, var. *pubescens* or "*Takmuk*" (Maráthi) before his mind's eye. I have not seen a fruit of this plant so definitely streaked. Hooker follows this description in the letter-press accompanying Tab. 6873 in Vol. XXII of the 3rd series of Curtis' Bot. Magazine, May 1st, 1886. The plate is a good illustration of the male flowering plant. My plate, be it observed in passing, is of the female plant with the fruit changing colour in the course of its maturity. The colour is rich, but not uniform; it changes from day to day from the bright green of its younger days to the golden yellow, orange, or bright vermilion of advanced life, interspersed with all the shades between, often exhibited on one and the same individual fruit, at one and the same time in its later life.

Hooker describes the flowers as sweet-scented. I think to some

the odour may prove not particularly agreeable—mawkish if anything. The fruit is seldom if ever pyriform, a form which has been observed by some writers. Dr. Dymock says the number of seeds ranges from 60—100. This is rather a high average for the Konkan, where perhaps the fruit is smaller. 20-30 is as good an average as I can strike. The whole fruit of the plant—the rind and pulp included—is intensely bitter, but, as has been noted above, the kernel of the seed is sweet. Dr. Dymock says the vine is not bitter (*vide* "Pharmacographia Indica," Vol. II., p. 71). I have now a section of the stem of the male plant before me. The bark and the wood are both bitter, but not half so bitter as the fruit.

In passing I may here observe that the size of the fruit, as growing in India and as noted by all Indian Botanists, is much smaller than that of the same fruit growing in Australia. Baron Sir Ferd. Von Mueller, the accomplished veteran Government Botanist of Victoria, notes that the *Trichosanthes Palmata* growing near Burnett River bears fruit 3-6 inches long, 2-3 inches broad (p. 187, Vol. VI., *Fragmenta Phytographiæ Australiæ*).

THE POISONOUS PROPERTIES.—The poisonous properties of the plant exist in the pulp and fruit-shell. The pulp acts like a drastic purgative when taken internally as a mere laxative. In producing this effect the plant partakes of the drastic properties of its congener *Ecbalium Elaterium* (Syn. *Ecbalium officinarum*) commonly called the squirting cucumber, which furnishes the British Pharmacopœia with one of its most powerful purgatives, known as Elaterium, which is the dried sediment of the expressed juice of the fruit. It may be noted that these purgative properties of the respective plants do not suffer on drying. The pulp and shell of *Trichosanthes Palmata*, even if dry, retain all their deleterious element intact. They soon soften when moistened with water, and are as potent as fresh fruit. It seems to me that *Trichosanthes Palmata* is more powerful in its action than *Citrullus Colocynthis*—another of its congeners from the *Cucurbitaceæ*, which is a recognized purgative in English and Indian Medicines. According to Charak, an ancient standard authority on Indian Materia Medica, *Trichosanthes Palmata* is a blood-purifier and a

nervine tonic. The root of it is besides used as a stomachic tonic. It is in the course of the administration of the root of this plant and of the pulp and rind of the fruit that I have seen the poisonous effects which I think are sufficient to justify the introduction of this plant among the Poisonous plants of Bombay. Roxburgh had heard of its poisonous effects on birds in his day. He notes that "mixed with rice it is used to destroy crows." Dalzell and Gibson note that it is much esteemed in India in diseases of cattle. Dr. Lyon refers to me (*vide* p. 199, Medical Jurisprudence for India, 1889) as having informed him of the fact that the fruit pulp is used by forest frequenters as a cattle poison. I have since met with cases wherein it has acted as a poison on men. When it is used for poisoning cattle it is mixed up with fodder. Sometimes however it has unexpectedly acted as a poison when administered medicinally to cattle for the cure of inflammation of the lungs. The fact that the root is used by Indian villagers for curing acute lung diseases among cattle has long since been noted by Wight. The unsuccessful efforts made at the instance of Sir William O'Shaughnessy and referred to in the Bengal Dispensatory (p. 350) to ascertain whether the fruit had any properties at all, by giving such small doses as three grains thrice daily, need not make us sceptical as to the truly dangerous nature of the fruit-rind and pulp. In small doses the plant root or fruit may act as a stomachic tonic, or may have no sensible effect. But when the pulp of half the fruit, or even a quarter is used—say if a dram or more in weight—finds its way into the human stomach it does not appear to be free from danger. Administered by ignorant or unsuspecting persons not necessarily with a view to poison, it has done harm; drastic effects have been known to follow. The dry fruit-rind or pulp when smoked is said to act beneficially in the cure of asthma. I have no experience of this myself. On the other hand, I have not heard of any poisonous effects following such administration. But I have known of cases of accidental poisoning when the fruit was administered internally as a laxative and was followed by drastic purgation and irritation of the *primæ viæ*. I know of no case however in which it has caused death, or has ever been used on men for criminal purposes.

DESCRIPTION OF PLATE B. (*a female plant*).

1. Central branch bearing leaves and a solitary female flower.
2. Growing end of a branch to the left of the reader.
3. Top row of fruits (4) showing different colours in the order of development from green to red.
4. Transverse section of the fruit through its centre with the green pulp and seed surrounded by the yellow rind.

(*To be continued.*)

HEREDITARY DISEASE OF THE BRANCHES AND
LEAVES OF *PICUS TSIELA*.

BY DR. J. C. LISBOA.

(*Read before the Bombay Natural History Society on
1st March, 1892.*)

You will notice on the table three specimens of branches belonging to a fig-tree known in this country by the name of *Pipree*. Specimen No. 1 bears large leaves. No. 2 is an abnormal branch bearing smaller leaves though of the same shape as No. 1. No. 3 is a branch destitute of leaves, in fact a dead one. There are also on the table three photographs, representing healthy, diseased, and dead branches.

DESCRIPTION.—*Ficus Tsiela*, Roxb., *Fl. Ind.* III. 549. *Pipree*, is a large tree, trunk greenish and smooth. Leaves long petioled, 2-4½ in. long, broadly-ovate or ovate-lanceolate, cuspidate or with an abrupt acumination, entire, smooth on both sides and shining, specially above, and marked with numerous parallel veins, generally from 8 to 10 pairs. Fruit paired, crowded on the axils of upper leaves, sessile, somewhat turbinate, smooth, size of a cherry, purple when ripe. Said to be common on the Ghats.

Is extensively planted as an avenue tree in Poona, and along the road leading from that place to Katraj Ghât, and thence to Mahableshwar. The blades of the leaves of the planted trees, seen by me in

Poona, are smaller, generally 3-4 in. long. Those who have travelled along that road or been in Poona must have noticed a curious phenomenon presented by the tree. From its branches may here and there be seen hanging large green balls like Chinese lanterns. They are oval or ovoid-oblong, varying in size from 2-3 feet or longer. These are composed entirely of numerous small leaves (I have counted about 1,650 in one single ball) thickly congested on small branchlets, also numerous and congested on larger branches. Seeing from a distance one is apt to infer that the leaves have been brought together by the viscid secretion of spiders or red ants; but a glance at the specimen on the table shows that they are free from one another and that the appearance is due to the innumerable short branches shooting out in close proximity to one another, and bearing small closely imbricated leaves. To understand thoroughly the formation of these green balls, let us examine the healthy branch and compare it with the abnormal one. In the former we see that it, the parent branch, and its secondary branches are long, smooth and alternate, arising at some distance from one another, being marked with an imperceptible line; the secondary branches arise rather irregularly, those of the same side at a distance of 3-4 in.; they never or very seldom give out branches, nor are they swollen at their origin. The leaves are large, long-petioled, and shoot out at a distance of 1-2 in. from one another.

In the abnormal branch this arrangement of secondary branches and their leaves is altered. Being stimulated by some cause or other the primary branch shoots out numerous short, thin or slender branches thickly congested. These in their turn give out shorter and still thinner branches, so closely approximated that the space between the internodes almost disappears. All the large branches and their divisions are swollen and knotty, specially at their origin and on the internodes. The swollen joints resemble small balls, size from a pea to a bottle-nut. The leaves are small, 1½ in. long, inserted on a more or less long petiole, and, as you see, highly crowded on the branchlets. These small dwarfish leaves are so numerous that, as I have previously stated, 1,650 leaves were counted in one single ball 3 ft. long.

At the commencement of this abnormal condition, or as I take it,

of the attack of the disease which is essentially chronic, the branches are not very short nor the leaves very small, but as the malady advances, the new leaves which appear at each successive season, become gradually more and more dwarfish in appearance, the branches turning knotty and producing new smaller ones. The old trees on which such phenomena take place, are covered with leaves of a paler colour and of rather diminished size, though not so small as those on the abnormal branches. The parts affected die a premature death; this is however a slow process.

The *Pipree* sheds its leaves in the cold season and renews them. This fact was observed by me last year, and in a short time confirmed by the experience of the natives and Europeans. This renewal takes place also in the abnormal branch, and continues from season to season for several years with this difference, that new leaves do not shoot out at each season or every 2nd or even 3rd from the branchlets, at their origin from the parent branch; thus they gradually become destitute of leaves from the lower or first attacked part to the free extremity and, at last, die. After a time the whole branch dies thus, and the dead branch, now dark brown or black, remains attached for a long time to the tree, resembling a broom from a distance. Now and then it happens that certain branches at their origin from a parent branch becoming thus affected form balls of leaves, and die in the manner described above. The parent branch, however, if strong and tolerably large, continues to grow, but ultimately it too becomes attacked and falls a victim to the morbid action which appears to have been extended from the primary or first attacked branchlets. It is curious that this process goes on whilst the contiguous parts of the tree are healthy. It is a well-known fact that in animals the death of the whole body or of a part of it begins to manifest itself almost always at the extremities farthest from the centre. Symptoms of leprosy, senile gangrene, and of various kinds of paralysis in man, are first observed at the tips of the toes and of the fingers. So also does a tree or a branch of a tree show signs of death at its extremity farthest from the roots. Just the reverse is the case with *Pipree*. You will observe from these specimens and photographs that the lower part of the affected branch is swollen, nodose, dark-brown, or a shy-coloured and destitute of leaves, whilst

the upper extremity of the branchlets still bear leaves. By this slow and steady process, the whole branch dies in the space of two, three, or more years. It appears that in the inferior, almost dead, part there are still some more or less altered vessels capable of carrying scanty nutriment from the trunk towards the few living leaves, and the sap elaborated by these back towards the trunk.

As to the history, no Indian botanist out of so many has made even a passing allusion to this abnormality. Dr. King, Superintendent of the Calcutta Royal Botanic Garden, who is the only one who alludes to it in his comprehensive monograph on the species of the genus *Ficus* says:—"All the specimens which I have seen issued by Wallich as 4,503, letter C, consist however of a *sport* of the tribe with small leaves and greatly elongated petioles which is not uncommon on old trees. This sport forms curious tufts on the ends of some of the branches, and can be seen growing in abundance in Madras." This is copied in Sir J. Hooker's *Flora of British India*. Dr. King does not state whether these tufts, which he calls *sports*, appear in wild as well as in cultivated trees, and whether they are to be seen in Bengal. Dalzell and Gibson, the authors of the *Bombay Flora*, say that *Ficus tsiela*, Roxb., is a very common tree in this Presidency as it is in other parts of India and Ceylon, but do not allude to the extraordinary phenomenon. May the silence of all the authors be due to the *Ficus* in the wild state being free from the disease, and appearing only in the planted trees in the Poona district and in Madras? Why should this be so? Again, may it be that the disease had not appeared in this Presidency at the time the authors of the *Bombay Flora* were living in this country, whilst it existed in Madras during the lifetime of Dr. Wallich? These are questions which must occur to many, and which, I regret, I am not in a position to answer. I have not observed this phenomenon in any other species belonging to the fig tribe, or to any other tribe or genus, though they may be seen growing in close proximity to *Ficus tsiela*. The disease, is, I think, hereditary, because it appears on trees grown from seedlings, or from healthy branches, but apparently it is neither infectious nor contagious, nor does it arise from the condition of the soil.

Many intelligent Europeans and Natives, who had noticed the green mass or tuft of leaves on the *Pipree* tree, had attributed it to some

parasitic plant growing from it, and some had even gone so far as to aver that similar phenomena (balls) might be observed on the mango tree, but when asked to produce specimens they brought a mass of *Loranthus longiflorus*, Desv., &c. I do not deny that the mango may not be attacked by the same or a disease similar to the one I am describing, but I must confess that as yet I have not seen a single well authenticated case.

Dr. King is, as you must have observed, of opinion that the condition of some branches and leaves above described is a *sport*. To this opinion are opposed the following facts:—Sports are almost always vigorous growths or off-shoots which appear in a vigorous branch of a healthy tree, this being generally young. Now the abnormal condition of branches of the *Pipree* tree appears almost always in an old tree, the leaves of which are always of a pale yellowish colour, branches dying sooner than the unaffected ones. At first only one green ball is seen upon a tree, but as the years roll on and the tree becomes older, it bears several such tufts.

I am inclined to think that this state of branches is a chronic and hereditary disease which in its course resembles cancer in the human body. This, as is well known, affects at first a certain part, say a female breast, and makes at first a slow progress, affecting one portion after another till the whole breast is destroyed by the mass of disease consisting mainly of adventitious cells. At advanced stages this dire disease extends to the glands in the axils, and takes all the malignant forms of certain tumours, and appears simultaneously or successively in various parts of the body.

The nodose branches resemble the nodose condition of the feet and toes of men suffering from elephantiasis of long standing. No cause can be assigned to this affection. Although carefully sought no insect agency producing the knotty swelling has been discovered. Dr. W. Dymock thought that it might be the result of an insect which he found in one dead branch submitted to his examination; subsequently careful examination revealed that it had accidentally gone into the interior of the wood from the basket in which it was enclosed. Mr. Woodrow, Professor of Botany and Agriculture of the Poona College of Science, examined under the microscope some branches without any result.

The following is the answer of Dr. Barklay to whom was submitted one specimen for examination:—

KENNEDY COTTAGE, SIMLA,

21st October, 1891.

"I have now examined the specimen of *Ficus tsiela* you so kindly sent me, but find no evidence that the abnormalities you observed are due to the fungal invasion. I made several sections of a twig bearing the smaller and more numerous leaves, and staining with Gentian violet could find no trace of mycelium. If you like, I will, with pleasure, send you a slide for your own inspection. It is possible that the drying of the specimens, while in transit, destroyed any mycelial filaments which they may have contained when fresh, though I do not think this probable. In the absence of a fungal cause I am at a loss to suggest any causation for the remarkable phenomenon."

AERIAL ROOTS.—It is believed by many, even by Botanists, that *Ficus tsiela*, Roxb., does not send down root-drops, or aerial roots. Some of the authors who have described the plant, are silent on the point, though they mention trees from the branches of which aerial roots shoot out. Dr. Roxburgh (*Flora Indica*) is explicit. He says:—"Bark smooth, greenish, no roots from the trunk nor branches." Wright in his *Icon. Plant.* says:—"It is very generally planted by road-sides for the sake of its shade, and by not sending down roots from the branches is so far superior to either *F. Indica* (Banyan tree) or *F. Benjamina*, Linn., the pendulous roots of which are often dangerous impediments on a road." Beddome, *Manual of Forestry*, says:—"No roots from the trunk or branches." Dr. King, in his memoir above alluded to, says:—"A large spreading tree without aerial roots, all parts glabrous." Sir J. Hooker in the *Flora of British India* repeats Dr. King's statement. Are we to think that trees in Bengal and elsewhere are free from this kind of roots? For there is no doubt that many *Piptos* trees (not all) are seen in Poona bearing down abundant aerial roots (see specimen on the table), though never so long as to reach the ground. Generally speaking, they are about one yard long. The roots of *F. retusa*, Linn. (Nundrook), and *F. Benjamina*, Linn., do not also, so far as my

observations go, reach the ground. I believe the only root-drops of *F. Bengalensis*, (Wad.) Linn., reach the earth.

It is not ascertained, at least no author I have consulted, explains why some trees should produce aerial roots and not others. Among fig-trees in a few species only such as Wad. *Pipree*, and *Nundrook*, *F. Benjamina*, Linn., and *F. Mysorensis*, Heyne, are such roots seen.

CURE OF THE DISEASE IN FIG'S TSIELA.—As to the cure of this abnormal condition which I consider to be a disease, it would, I think, be considered absurd by some that I should propose such a thing, especially in a country where valuable fruit-trees such as the mango are allowed either from apathy or ignorance on the part of the proprietors to be destroyed by the attacks of parasitic plants, without employing such a remedy as that of cutting them down as soon as they make their appearance.

The *Pipree* is only used as a shady avenue tree, neither its wood nor fruit being of any value. The ball-like green masses of small leaves hanging like Chinese lanterns add at first to its beauty, but in course of time they die, remaining attached to the tree as an ugly appendage for a great length of time, often many years. Then the leaves of the entire tree thus attacked become smaller and of a rather paler colour than in health. To prevent this, I would recommend those who have opportunity, to watch the disease carefully for years, to find out whether it is caused by an insect puncturing a branch or fruit, &c., and whether by cutting the first branch, in which the disease appears, it be possible to arrest its further progress as is done by extirpating a cancerous part of the human body. The *Pipree* plant is certainly not of much value, but the experiment is recommended in the interest of science, for if a remedy be found, or if the cutting of a branch lead to the arrest of the disease, the fact may lead us to the knowledge of some other phenomena of plant-life, and give us an insight into the nature of this and similar abnormal conditions. As Dr. King thinks that it is a sport—I would ask you to plant this sport in good season and appropriate soil and see whether it can be reproduced.

Besides the photographs already mentioned at the commencement of this paper, there are on the table others which give graphic

representations of the trunks of *Ficus Bengalensis*, Linn. (Wad), *F. religiosa*, Linn. (Pipal), *F. tsiela*, Roxb. (Pipri), and *Pangamia glabra*, Vent. (Karunj).

TRUNK OF THE FIG TREES.—Now I would call your attention to the conformation of the trunk of the fig-trees in general. This is marked by several more or less deep furrows, which, however, very seldom extend beyond the large primary branches. They are sometimes so deep as to make it appear that two or three trees during their growth are united together. This appearance is still more delusive when the ridges, which form the walls of the furrows, continue down to the roots. Occasionally the trunk of a tree is divided by a large furrow into two parts, which are held together by a sort of diaphragm or flat central portion. I have seen a tree of this kind at the foot of the Katraj Ghât, on the left side of the road leading to it, and another in the city of Poona. The trunks of all the young trees, cultivated or grown from seedlings, are round. It is only after years that they show a tendency to become irregular. This conformation of the trunk is common to all fig-trees, though more marked in some than in others; thus in the *Pipal* (*Ficus religiosa*, Linn.) the trunk is much disfigured by ridges and furrows being divided and subdivided in all directions, and the latter (furrows) being deep here and shallow there, or the former becoming more or less prominent and sharper in one place than in another. Roxburgh in his *Flora Indica* notices this condition thus: "trunk (of *Pipal*) erect, in small trees round, when large and old, it becomes full of irregularities, i. e., large perpendicular ridges and hollows as if many trunks were united."

The same botanist describing Wad (*Ficus Bengalensis*, Linn.) says: "Trunk when young is distinct and single, at all times its form, thickness, and height very variable, still more so than *Ficus religiosa*, Linn., because generally reared from branches procured naked and stuck in the ground." It is well known that Wad (*Ficus Bengalensis*) is enormously extended by the aerial roots descending and fixing themselves on the ground and gradually increasing in size, and becoming similar to the parent trunk. I have seen on one tree in Poona these aerial roots gliding over the trunk, increasing its thickness and adding a ridge or ridges to the already existing ones.

The irregularities of the trunk of this fig-tree, and of other species I am speaking of, are caused independently of the aerial roots. They (the irregularities) are not confined to the trunks of the fig-trees alone, but are also met with in those (though to a slight extent) of *Poinciana* (*Cesalpinia*) *regia*, Bojer, and of several other plants, specially trees of long standing. The cause of this state is not well known. Mr. Woodrow, of the Poona Science College, thinks that surface-growing trees are thus furrowed. Why these should be so is not clear, inasmuch as there are many surface-growing trees, such as palms, the trunks of which never show a tendency to this kind of furrowing. It is true that the roots of such trees spreading over the surface are prominent, and appear to form ridges; these are like buttresses, but do not produce the trunk. The food they absorb from the earth is taken up to be elaborated by the leaves, and thence it descends to nourish the whole tree.

I believe that the ridges are due to the vigorous growth of large primary branches; for on close observation it will be found that the former are in a line with the latter, becoming large and more prominent as they descend towards and into the roots. In their descent the ridges sometimes bifurcate or divide themselves into more than two ridges. The space between the ridges form furrows which are deep or shallow according as the former are prominent or less vigorously formed.

I believe that the sap descending from the branches contributes to the enlargement of that part of the trunk which is opposite to them by supplying it with more nourishment than the contiguous part. In corroboration of this comes the fact that the aerial roots of Wad (*Ficus Bengalensis*, Linn.) and of other trees, before they reach the earth and fix themselves into it, are chiefly supplied with nourishment from the parent branch. In fact all the parts of a tree are nourished from above.

HORSE-BREEDING IN INDIA.

BY VETERINARY-CAPTAIN G. RAYMENT, A.V.D.,
 Assistant-Superintendent, Horse Breeding Department for
 the N.-W. Provinces and Rajputana.

(Read before the Bombay Natural History Society on 3rd May 1892.)

I feel in writing this paper, that I am almost presumptuous in publishing my opinions on Horse-breeding in India, after an experience extending over only five years of actual work in my department, particularly when there are still amongst us such masters of the subject as Major-General Parrott, Messrs. Hallen and Kettlewell. But with the exception of a few articles in sporting papers, a pamphlet or two, and the reports of the Stud Commission, the ripe experience and knowledge of these gentlemen have never been placed at the disposal of the public. My chief object in bringing this subject before the Society, is to provoke a discussion, and enable us to get at the opinions of practical horsemen and breeders all over India. I therefore trust that nothing in this paper may be taken as spoken *ex cathedra*, but simply as the opinion of one still a student, and anxious, by comparing his views with those of others, to impart what little knowledge of the subject he may possess, while correcting his own errors, and learning fresh facts from the free discussion which he trusts will follow.

Considering what a "horsey" nation we are, it is curious how few understand anything of practical Horse-breeding, and how little it is studied scientifically. Patience, time, and money are all required to breed good horses, combined with a special aptitude for the work, great powers of judgment, and practice in the art of matching the mare and stallion. Few possess these qualities; hence, breeding is frequently "hit or miss," and good horses are produced accidentally instead of being the result of forethought and science. A Thoroughbred, *i.e.*, pure bred horse, must have five top crosses. Thus, five generations are necessary to get hereditary qualities fixed, or we have no surety that the stock may not throw back. Conformation, colour, temper, constitution, and unsoundnesses of many kinds, or a tendency to them, are hereditary.

Conformation.—Defects and excellences are both inherited. Crooked legs, toes in or out, straight shoulders, and many others.

To eradicate them, one cross is not sufficient, as the defect may miss a generation and appear in the next. By continually crossing, for instance, with good sloping-shouldered stallions in several generations, a straight-shoulder would be got rid of, but not in one or two.

Constitution.—Weak constitution is inherited, especially that known as *washy*, i.e., horses sweating easily, liable to diarrhoea when worked, and apt to get superpurgation from a very small dose of purgative medicine.

Temper.—Many vices, buck-jumping in Australians, impetuosity and excitability are inherited.

Colour.—Is also inherited. Europeans prefer bay, black, dark chestnut, and brown. Hence these colours are selected for breeding the best class of horses. The result is, we practically never see roan, grey, dun, or piebald Thorough-breds. Horses of these colours in England are coarse and to be avoided, except greys and sometimes roans. Grey is a favourite colour amongst the Arabs, so out here many excellent horses are of that hue. Witness the pony "Blitz," the famous "Greylog," and others. Since long-range rifles and guns have come so much into use, greys have been objected to for Army purposes, as they are so easily seen. Hence they will probably die out; in the meantime they are becoming cheaper. *Native* princes like dun as a colour; the result is good dun horses and ponies are by no means uncommon in India. For generations they have been well cared for, and the best stallions and mares amongst them purposely mated to reproduce that shade. They frequently have noses, arms, scrotum, and sheath pink, and blue eyes. This, though hideous in the sight of an Englishman, is much approved by many natives.

Unsoundness.—The following are the principal hereditary unsoundnesses, or, strictly speaking, unsoundnesses, a tendency to which is hereditary:—

Constitutional Ophthalmia.

Cataract.

Amaurosis.

Glaucoma.

Iritis.

Roaring and Whistling.

Splint.
 Spavin.
 Ringbone.
 Sidebone.
 Laminitis.
 Navicularthritie.
 Curb.
 Defective feet, &c.

Tendency to brittle feet, weak soles, flat soles, sand-crack, &c. Lameness, produced by strains, sprains, break-down, dislocations, fractures, etc., is not transmitted. Especially avoid unsoundness in dam or sire. The tendency to it is always inherited, and no amount of crossing seems to eradicate it. The famous "Ormonde" is one of a family of Whistlers. "Galopin," the sire of "Donovan," is coarse hocked. "Godolphin," a son of his, now in India, is markedly defective in his hocks, and his stock are frequently spavined. By breeding always from one particular stamp possessed of certain qualities which we wish produced, we get at last a breed or variety of a race. In nature, Darwin says this is done by natural selection. Let us take birds. Say a certain male bird by accident gets a few feathers on the top of his head forming a slight crest, and this crest takes the fancy of the hens he will mate more easily than his fellows. His sons will probably have these small crests and are quite likely to mate in after-life with their sisters, this will accentuate the tendency to produce crested males, and if, again, incestuous mating occur, the tendency grows stronger, so in the course of many years, perhaps thousands, a crested race is produced, hoopoes, bulbuls, etc.

This is the way Darwin contends that race varieties are formed in nature. Now, here is what we also want to do in breeding domesticated animals and to form a variety which shall possess certain qualities or conformation, rendering them more serviceable for the purposes for which we require them. We cannot wait, as nature does, hundreds or thousands of years, but must stamp the qualities we want speedily. Say we want pace—we take a stallion of great galloping powers (irrespective of other qualities), and put him to the fastest mare we can get; the produce we mate with its own sire, if a filly; with its own dam if a colt. This accentuates the

power of speed; and the system carried on results in very fast stock, such as the Thorough-bred English horse of to-day. This is called breeding "in and in." But in producing an especial quality like this, we also produce others which are not always beneficial. We rarely get strength combined with speed; hence, the stronger horses being slower are not bred from and, as we can see any day in England now, we get any number of race horses possessed of marvellous powers of speed for a short distance, carrying a very light weight, but only with a very few, who can gallop, say, five miles with 14 stone up. When we do get them, they are of course the best animals in the world, but they are rare. To get this speed too, stallions and mares are employed that are unsound and of delicate constitution, hence many Thorough-bred English horses go wrong in training, either lame, or get knocked up. In cattle this is very marked in Short Horns, a breed produced by "in and in" breeding. They are immense animals, growing very big while still mere babies and fatten very rapidly, hence they should be extremely valuable and profitable to farmers, but, unfortunately they have a tendency to tuberculous, which has been so much enhanced by "in and in" breeding that it has now become a perfect plague amongst Short Horns. Many breeds of dogs, bred to win prizes at Shows, are similarly affected with hereditary tendencies to certain diseases.

Throwing back.—An animal is said to throw back, when he inherits some quality from an ancestor which his own parents have not. If a colt have a big head, and his sire and dam small or ordinary sized ones, we frequently find on looking back that his grandsire or dam, or great-grandsire or dam was possessed of such a peculiarity. It is the same with other qualities.

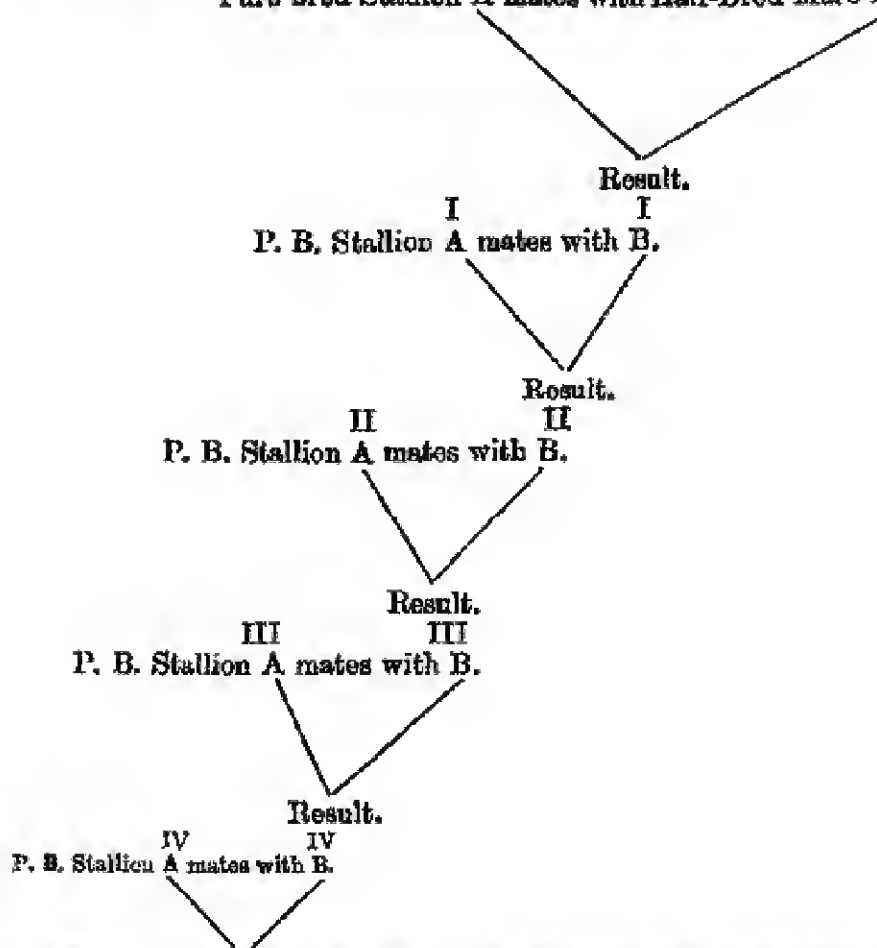
Crossing.—If we put a mare of one breed to a stallion of another, it is called "crossing," and the progeny is "half-bred." A "half-bred" hunter for instance is a horse whose sire was a Thorough-bred. *Mongrel* is a horse, neither the dam or sire of which is Thorough-bred in the sense of pure bred, and therefore the progeny is of very mixed blood, in fact, no particular breed at all. He is generally too an animal of low courage, small powers of endurance, and often vicious. If he is well shaped, it is a mere chance, as he may throw back to any ill-shaped progenitor or perhaps combine the defects of several.

Nicking.—This term is used by breeders to denote the matching of the mare and stallion. A mare is said to have *nicked* well with a horse when the offspring is satisfactory, or badly when the reverse is the case. Also certain breeds are said to *nick* well with certain others.

Strains of blood—Mean that a family of horses have been crossed a generation or more back by some particular breed or well-known orse. Thus we say of a horse, perhaps Mongrel, "he has a strain of Thorough-bred blood," or "he has a strain of 'Hermit' blood," meaning the race-horse "Hermit."

Last Top Cross—Means the cross between the sire and dam. A pure bred horse must have five top crosses. *sic.*

Pure bred Stallion A mates with Half-Bred Mare B.



Result BV being pure bred. The half-bred taint in the mare B being now supposed to be eradicated.

The Progeny is supposed to take after the sire, in the conformation of the fore limbs, in strength, energy and capacity for work. The mare gives height, size, and shape behind. But this rule is general to which there are many exceptions.

Age.—The foal often takes after that parent which is in middle life and therefore most vigorous.

Breed.—The better bred parent also stamps him or herself more markedly on the progeny. So strong is this that many horses are noted for what is called stamping their stock.

Sex.—A colt takes after the sire, a filly after the dam.

Stallions and mares.—We must now pass to the mating of the stallion and mare. In the first place we will consider the stallion. Whatever class of stallion we wish to breed from, he should be the best of his kind, free from vice, hereditary unsoundness, and of good conformation. It is a mistake to suppose, for instance, that if a stallion has an ugly head we can modify or alter the head of his offspring by putting him to a mare with a small well-shaped one. Stallions in this country are generally larger than the mares. But we should avoid too large a sire or we may injure the mare in copulation. Nor will it necessarily follow that the foal will be very large and vigorous. The Oriental breeds used by Government in India are Arabs, Persians, Country-breds, Turkoman, and Stud-bred.

Arab stock are well shaped, hardy and good-looking, have great powers of endurance, are good goers, have good feet, good tempers, are often fast, and make troopers for Native Cavalry. The stallions themselves too are hardy, and will keep health and condition on food, and in a climate where other horses would die. They are generally good tempered, which is a point of some importance, as an impetuous vicious stallion is often very troublesome, and gets himself disliked by the syces and mare owners. The drawback to the Arab stock is that it is generally wanting in height, has insufficient bone below the knee (shank measurement), has too long and sloping pasterns, and is frequently narrow chested, and rilly. Also the Arab often, when not quite pure bred himself, fails to stamp his stock, and it takes after the Country-bred's dam, showing the crooked hind limbs, cow-

hocks, and falling away behind of the mother. Arab stallions are best fitted for districts where grain and forage are scarce, and the people poor, and unable to feed their youngsters well. As already mentioned, Arabs will grow into useful animals on food that would stunt the growth of English stock, and produce weedy, misshapen, worthless creatures. Arab stock in England grow large, because they get well fed, and both climate and soil are favorable to their development. Again, well-bred Arab stallions may with advantage be put to pure bred, big, roomy mares, to produce foals adapted for generally useful purposes. The cross of Arab blood thus infused gives the progeny beauty, endurance, and spirit. But be careful that the mare is pure bred, if mongrel, and holding strains of a variety of breeds, the progeny will be mongrel too, and may throw back to one or more of its maternal ancestors, and you may get an ill-shaped brute not worth rearing.

Persian.—I am not greatly in favour of this class of horse, for the reason that he is not "true bred," his pedigree is doubtful, and being mongrel himself it is not possible to tell what his produce will be like. I have seen but little of the stock of Persian horses in India, and those I have come across have not impressed me very favourably. There are, moreover, but very few of this class of stallion in the country. In my opinion all the good qualities of the Persian or Gulf Arab he owes to the infusion of pure Arab blood, and the stronger they hold this strain the better they are. As far as their powers of endurance, ability to live on short commons, and hard indigestible food goes, they come next to the Arab. But they want his speed, his courage, and his good looks. They are sluggish tempered, and lymphatic, especially when gelt. They have, however, generally the advantage of size, standing higher, possessing more bone and substance, and are good tempered.

Country-breds.—We sometimes find very good horses of this class, sired by a Government stallion. If his pedigree is not crossed too much, so as to make him a mongrel, he often proves a very useful sire. It is not possible to describe a Country-bred stallion in general terms, as so much depends on whether he is of Thoroughbred, Half-bred, or of Arab descent. Care should be taken in this class of sire to reject such horses as show the defects of the Indian

animal, such as straight shoulder, narrow chest (legs both coming out of one hole), toes in or out, want of bone, want of depth, want of substance, cow hocks, hocks away from him, sloping croup, or falling off behind. These being the faults of the Country-bred mare, if she be put to a Country-bred stallion possessing them, they will be accentuated in the stock. I have purchased a few Country-breds for stallions in the last few years, and their stock, although promising, is not yet old enough to show with certainty what they are worth. Many persons in India are possessed with the idea that in a certain number of years we shall be able to do without imported stallions, and to select from the improved Country-breds our future sires. This is in my opinion visionary; for, except in a few districts in the north, specially favoured by climate and soil, the indigenous Indian horse is small, narrow, and wanting in bone and substance, and to this type there is a strong tendency to revert unless a continual supply of foreign blood be imported to prevent it.

Turkoman.—The real Turkoman is a pure bred horse, and the best of them are very fine animals, well calculated to make excellent stallions. The prices asked for these are enormous. They are big horses, over 15 hands, possess much bone and substance, good shoulders, and do not fall off behind. Their hardness and powers of endurance are historical. Chestnut is a common color. Unfortunately the general run of Turkomans, although standing high, are narrow, rilly, and want bone. There are also many so-called Turkomans which are Mushids or half-bred Mushids, and this class are a poor lot, coarse, soft, and currish.

Stud-bred.—This class, bred in the old Government Studs, is now extinct. They were fine horses, and many excellent animals were bred from them; unfortunately the stud authorities crossed their stock injudiciously, and the result was, that these stallions were far from pure bred. As they were put to mongrel mares, it was a mere lottery as to whether the stock obtained was good or bad.

Amongst other *Indian* breeds are the Kathiawar, the Dekani, the Wuzuri, the Kata, and the Punjabi.

Kathiawar.—Were good, often mouse-coloured, and had almost invariably a list, and often donkey marks. Now spoiled by injudicious crossing.

Dekani.—A good hardy pony, but small and light. Practically extinct.

Wusuri.—Good looking and hardy, but light. Has curiously pointed ears.

Kata.—A breed in the Mozuffarnagar district. Encouraged a good deal by the Sikh Rajahs for Cavalry purposes. They were large, big-framed animals, and of a good stamp. The Kata still produces good animals.

Punjabi.—Bad colour, white, dun, etc. Pink nose, sheath, arms, etc.; but large, and frequently possessing much bone and substance. A favourite stallion with many natives, but disliked by Europeans for his colour, heavy shoulder and bad action. All the same, there are many good horses amongst them.

Other stallions are Thorough-bred, Norfolk Trotter, and Half bred, Water, Cape, and New Zealand. These may be called Foreign or Exotic horses.

Thorough-bred English.—About this horse opinions vary so very widely that I almost fear to touch on the subject at all.

I know my ideas differ considerably from those of many experienced men, and are likely to call forth, if not a torrent of vituperation and indignant denial, at least sneers and contemptuous remarks. Let me preface the expression of my opinion by stating that I consider a *good* English Thorough-bred the finest horse in the world. As a stallion racer, hunter, or charger he is unequalled; but unfortunately the *good* English Thorough-bred is not common, and there is an enormous demand for him; hence, his price corresponds. If breeding in India were on a small scale, Government could go into the market against the private purchaser, and by the length of its purse, beat him and obtain such horses as by breed, shape, and general conformation, would in a very few generations supply us with magnificent stock. This is, however, not the case. Exclusive of Bombay, Government use 800 stallions in India, and could not possibly afford to pay the enormous sum which would be required to have them all, or a majority of them, the best class of Thorough-breds, even if this large number were procurable, which I very much doubt. The Thorough-breds now imported for stud purposes, though I honestly believe the best to be had at the price, £ 250 to

£400, are not, as a rule, the class of horse calculated to improve the indigenous stock. The latter want size, substance, bone, and shape. And I assert that the class of Thorough-bred for which the Government can afford to pay, and which exist in sufficient numbers to supply the demand, are not capable of producing such improvement. I do not make this statement on theoretical grounds, but as the result of careful inspection of many hundreds of their stock in the Punjab and N.-W. P. Let me now endeavour to account for this.

For many years past this class has been bred for the turf, *i.e.*, for speed. A winner of races, be his faults what they may, when his career is finished, retires to the stud. Here, he is mated, not with mares selected for roominess, bone, and substance, but with mares whose speed has also been proved by their feats on the turf. Soundness, constitution, conformation, in fact every quality desirable in parents of good stock are overlooked, if the dam and sire are speedy. The breeder gets what he wants, fast animals capable of covering a certain limited distance in an amazingly short period of time, carrying a very light weight.

Now, as breeding this class of horse is expensive, a quick return on the outlay is necessary to make it profitable. To obtain this, the stock is forced to precocious maturity by high feeding.

The colt who should still be running in the paddocks, developing bone and substance, and maturing naturally into a fine horse, finds himself at two or three years old facing the starter on a race course. Now what results would any horseman predict from this? *First*—soundness not being a *sine quâ non*—unsound stock. *Second*—lightness, length, and a long stride being favourable for speed, want of substance and narrowness. *Third*.—Precocious maturity by artificial means, *i.e.*, high feeding and pampering—delicacy of constitution and early failure. *Fourth*.—Taxing inordinately; immature bone, tendon, ligament and wind, splint, spavin, sprain, breakdown, and roaring.

Are these predictions verified? For answer observe the Hansom cabs in London and other large towns. Ask the Veterinary Surgeons and trainers at racing centres.

On the other hand their advocates contend, and very justly, that the Thorough-bred hunter for speed, endurance, power,

courage, and fencing, is *par excellence the horse*. Exactly so. Let us trace his history, and we find he has proved as a young horse too *slow* for the turf. The very qualities that give him his long staying powers and big jumping capabilities, militate against the terrific speed required for the modern racer. Again his price is very high, even hunting men with long purses, ready to give fancy sums for blood horses, find it difficult to obtain what they want, the difficulty yearly increasing. In other words, the demand is greater than the supply. One more objection, last, but not least. These horses are *castrated*. Firstly—because they would be too troublesome in the hunting field with mares. Secondly—they would not beget the speedy stock required for the turf, for, although faster than anything they meet with to hounds, as before remarked they are too *slow*, to meet their woody, speedy relatives for short distances, carrying small boys, on the turf.

Under these circumstances, I am not an advocate for the indiscriminate use of the Thorough-bred English as a stallion in India. But there is no man in the country who more upholds his employment in a judicious manner, mating him with mares of the proper stamp in suitable districts as a cross. The stock not to be bred from, but utilized for Cavalry, riding horses for the public, and light draught, leads in Artillery, etc. The proper stamp of mare to mate the Thorough-bred with is a *pure bred*, sound, roomy, deep-chested, big-girthed animal, with plenty of bone and substance; height at least 15 hands, age not less than five. To put my opinion in another way, and in fewer words, I consider the Thorough-bred that Government can afford to purchase for India is not calculated to produce, when mated with the indigenous mare, the class of stock required for military, or general utility purposes; but an admirable stallion, if mated with judiciously selected pure bred mares, the produce of a larger, if coarser, pure bred horse. This applies equally to the Arab. If I understand Mr. Hallen's views correctly, these have been the lines he has worked on, in his efforts to provide us in India with a good useful stamp of animal. After considerable experience and much thought, I have come to the conclusion, that they are sound, and will give us the best results if he be allowed to carry them on without injudicious interference. A description of a

Thorough-bred English horse would be a work of supererogation, so I will omit it.

Norfolk Trotter.—Here again I fear my views will meet with scant approval in many quarters. The "horsey" public in India are generally the racing public. Apart from those interested in the turf, there are but few men, even in the Army, who take an interest in the question of breeding, and still fewer, whose opinions are valuable, either from experience or study. Hence a sire that cannot gallop, and whose pedigree holds no strain of racing blood, is to most men "anathema marantha." The Norfolk Trotters have been overwhelmed with a shower of abuse from all quarters. Hallen's foals (not foals as I once saw it printed), three-cornered, hairy-legged devils, plough horses, and conservancy cart horses, were some of the epithets applied to them. Of late years, the tide has turned, the numerous fairs, held annually in the Punjab and N.-W. Provinces, have given the public a chance of seeing the stock of these much abused stallions for themselves. Their superiority to other classes has been so palpably shown at these gatherings that both civilians and soldiers are confessing themselves converted. But they have still many bitter opponents. The Norfolk Trotter is by no means the coarse, hairy-legged animal that people have been taught to believe. A good specimen is a compact, well ribbed-up horse, with great girth and shank measurement, standing level on short legs, very short shanks, large flat knees, well developed square hocks, and is singularly free from disease of the feet and eyes. He has first class action at the trot. I would employ none without five top crosses, ensuring purity of pedigree. Unfortunately we cannot always obtain exactly what we want. A certain number of the horses that have come out to India, are not of pure pedigree, are coarser than they should be, and wanting in action. But with all these faults, they have done an immense amount of good, and are continuing to do so. Let any one, however prejudiced, see a collection of branded mares of all ages, and he will be forced to confess that the young mares are far superior to the old ones, and with a little trouble it can be easily demonstrated that the improvement is progressive, each generation being better than the last. Consult the birth certificates, and it will be found that the big roomy mares

are sired, grandsired, and even great grandsired by the Norfolk Trotter. Frequently we get monstrosities in the shape of a colt with a Norfolk Trotter body and Country-bred legs, a wretched animal whose legs are not fit to carry his body. This sort of beast is a perfect godsend to the Thorough-bred advocates. His shortcomings are trumpeted abroad, and, if he be found in a fair, the whole place rings with the discovery. There may be twenty head of nice stock by Norfolk Trotters in his immediate vicinity, but they are never taken notice of. The goose amongst the swans attracts all eyes. Yet these very men on a judging committee at a fair, will turn the Thorough-bred stock out of the ring in shoals and be very much surprised when they are informed at the end of the business that the major part of the prizes and all the highest have been awarded by their own decision to Norfolk Trotter stock. This I have seen not once, but over and over again. Some years ago an Artillery Officer walked round some stables in India, holding 25 or 30 Norfolk Trotters; before starting he was asked to point out any he considered *too coarse* for Field Artillery. From the lot he selected *two*; when asked if Field Artillery never received *Walers* as coarse, he confessed that they did, and coarser.

Now, if the stallions themselves are not too coarse for Field Artillery (I am certain many a Colonel of Dragoons would be glad to take the majority as remounts in the ranks of his regiment), how can the stock of such horses, out of lighter mares than themselves, be too coarse for Army purposes. This is a conundrum I am unable to find an answer for.

The Half-bred English.—This class I am not an admirer of. Undoubtedly many are fine horses, and some of the sires from General Parrott's stud had a strain of this blood. The most popular horse in the Horse-breeding Department of the N.-W. P. was a stallion of this breed, so much so, that advances were made by dealers on his unborn foals. But in spite of this, I distrust a cross-bred horse, especially when put to an equally cross-bred mare; the result must be mongrel, good perhaps, but quite likely to be worthless, and, if a filly, not likely when her time comes to add to the equine population to produce anything worth having. The *Half-*

bred is impossible to describe, as he may have been thrown to his Thorough-bred sire, or his coarse-bred dam. In consequence he may look a well-bred, handsome horse, or a coarse, ugly one. Specimens of each may be found in India.

Australian Waler.—Generally Thorough-bred. They are, I think, more delicate in India than the English Thorough-bred, and I have found their stock disappointing. This I am told was also acknowledged to be the case in old stud-days.

New Zealanders.—As far as I am aware have not as yet been tried.

Cape.—Have now become extinct. I am informed that there used to be some very superior stallions of this breed in former days in the stud. Captain Nunn, D.S.O., of the Army Vety. Department in his report on the Cape horses, published a few years ago, speaks unfavorably of the present breed.

Mares.—Speaking in general terms, the indigenous equine of India is really what would be considered in England a pony. Gifted with marvellous powers of endurance, ability to live and work on a minimum of food, and capable of continuous exertion for long periods. These are the good qualities of the race. On the other hand, as a result of many generations of ill management, want of knowledge and care in breeding, climatic influences, and bad keep, they are narrow, wanting in middle piece, in bone, in height, and in action. Though often of fair conformation in front, they nearly always fall off behind, drooping quarters, narrowness across the hips, sickle, or cow-hooks are the rule, not the exception. This is the class of horse that is at our disposal to produce remounts for the Army and useful horses for the general public.

Without doubt exceptions to the above may be found, and there are in the Punjab and on the Frontier several breeds which furnish promising brood mares, of fair height, bone, and substance. In Bombay too, Kathiawar and the Deccan produced in the old days a good class of animal, but now one is met on all sides by lamentations over the decadence of the Kathiawari, and the almost utter disappearance of the little Deccanni.

The problem to be solved, or, I may say, in course of solution is, 'What are we to do to improve the indigenous stock up to the

needs of our requirements, starting with the class of dams described above?" To answer this question, the following points must be considered, as they affect the various districts:—

1. Climate.
2. Soil.
3. Nature of crops.
4. Extent of Waste or Pasture Lands.
5. Poverty, wealth, habits, and customs of the inhabitants.
6. Will horse growing pay better than grain or cotton growing?

1. *Climate*.—Much depends on climate. A dry, warm climate is undoubtedly favourable for the development of equines, and could the necessary nutritious grains and grasses be grown under such conditions, there would be no hesitation in at once selecting countries like Arabia, Afghanistan, Sind, etc., as the best breeding grounds. Unfortunately dry heat means generally a scanty water-supply, and deficiency of forage and grain. The result being that the young stock do not get enough to eat, and never grow to any size. On the other hand, a damp, warm climate is fatal. Bengal, many parts of the Madras Presidency, the greater portion of the Indian coast, are eminently unsuitable to breeding. As a rough practical rule, we may say, that where rice flourishes horse breeding will not. The same rough rule applies I am told to tobacco.

2. *Soil*.—Damp, marshy soil is unfavorable to the rearing of good stock. Horses brought up on such land are soft and washy, their bones spongy and wanting in hardness, feet large, flat, and the horn soft. Well-drained, light land, rather sandy is the best we can have. Between those two extremes we get, of course, all varieties; but, as a general rule, the drier and better drained the land, the more adapted is it for our purpose. The presence of lime in the soil is indispensable for young stock. Bone is made up largely of this substance and, if it does not exist in the soil, the herbage cannot contain it; as a result, the bone of animals reared in lands deficient in lime, is wanting in earthy constituents and is too soft to be of any use. Not uncommonly such soft bone bends and we get crooked legs, etc., etc., in fact, ricketts.

3. *Nature of Crops*.—The nature of the crops in a district have much to say to the production of horses. Where barley, chennah,

etc., are cheap, where kurbi and bhoosa are plentiful, where such grasses as Dub (*Cynodon Dactylon*), Anjana (*Pennisetum Cenchroides*), Sanwak (*Panicum Crus-Galli*), Makra (*Panicum Egyptiacum*), Jurgah (*Andropogon Annulatus*), Kewai (*Panicum Cilare*), etc., etc., flourish, there we can raise big horses. The young stock are well fed. The climate and soil favourable for such crops are also favorable for horses.

Again, where scanty crops and coarse unnutritious grass only are obtainable, we can raise only scant crops of horses. And these, though they may be good of their kind, and, for hardiness and endurance, superior to their better fed brethren, will never grow to the same size.

4. *Extent of Waste or Pasture Lands.*—Of late years owing to the immense increase of the export trade in grain, its cultivation has received a powerful stimulus.

Hence, lands that a few years ago were lying waste and only used for the grazing of cattle and other stock are now put under the plough, and produce wheat and barley instead of bullocks, cows, sheep, and horses. It was always difficult to induce the horse-owners to allow sufficient liberty to their stock, but now-a-days, over a very large part of the country, liberty is impossible, as there are no pastures to allow them to run on. Where grass could be had for the cutting, it is now rather an expensive luxury, for, instead of more or less extensive maidans in the neighbourhood of every village, we have square miles of grain and cotton, and the grass growing on the bunds and paths that intersect these fields is jealously guarded by the owners, who can barely get enough of it to feed the bullocks they require for their ploughs and wells. Owing to this too the question of grass supply for Army horses is daily becoming a more serious one, and Government has had to face the difficulty by allotting grass lands to the various mounted branches in the neighbourhood of Military Cantonments.

5. *Habits and customs of the people.*—The tastes, castes, manners and customs of the inhabitants of a district have a great deal to say to the number and quality of the horse stock they raise. Many castes have a natural taste for horses, and, although their ideas on equine matters but rarely accord with ours, still they make

fair stock owners and take great interest in the subject. In former days, when every man's hand was against his brother's, and each petty Raja or Chief made war on his fellow at his own sweet will and pleasure, a good sword and a good horse were considered a very sufficient outfit for any smart young fellow. The most important part of the forces employed in these petty wars that raged interminably throughout the land consisted of horsemen, hence all the warlike tribes took the greatest interest in the breeding and rearing of the horse. With the advent of a settled Government under British supremacy these turbulent days passed away, and the need for large numbers of horses in every petty state passed away with them. The taste rapidly decreased, and we now find a very large proportion of natives utterly indifferent to, if not disliking, the noble animal. The extension of railways has helped also in still further rendering the horse less useful to our native fellow-subjects. In former days when a respectable person wished to make a journey, his ladies travelled in bullock carts, while he himself with the other males of the family rode; now he simply takes tickets for himself and his belongings from one station to another. It must be borne in mind too, that the zamindar never uses horses for agricultural purposes. In the old days of course they were wanted for military work, and now the custom of using bullocks is much too deeply rooted to be overset by anything we can teach him for the next century. But in spite of all these disadvantages, there are many districts in India where the zamindars are fond of horses, and, if encouraged judiciously, will continue to own mares and breed stock. Chief amongst these are the Rajputs who make the best owners and breeders of all. Mussalmans in the N.-W. P., though fond of riding and sport, do not, in my experience, pay sufficient attention to their dams and stock, and often feed them insufficiently. Amongst the Goojurs we get many successful breeders, but the lowest class Ohnmars, etc., are almost invariably bad owners. Many Sikhs and Punjabi Mussulman are keen and do well; and of course the Wuzuris, Brohois, and other Afghan tribes are born horsemen and know as much about practical equine matters in their own way as we do.

In Bombay the Mahrattas, judging from their history, ought to be

good men, but my experience of them in connection with breeding is very limited.

6. *Will horse growing pay better than grain or cotton growing?* As already mentioned, when speaking of waste and pasture lands, the export of wheat and cotton have increased enormously of late years. This has militated considerably against breeding in many districts. Formerly where one might easily find fifteen or twenty mares in a village, now none or only one or two exist; the reason being that more money is to be made out of grain, cotton, etc., than out of horse rearing. The zamindar, alive to his own interests, sells his mares and puts his money into bullocks, well digging, etc., to raise what will pay him best. If we could induce him to use his mares in the plough, in drawing water for irrigation, etc., etc., instead of his non-productive bullocks, an immense step would be taken in the right direction. For various reasons, the chief of which is his intense conservatism, nothing will persuade him to do this. There we have one of the many difficulties to be contended with in India. The zamindar keeps his mare simply to breed from, and with the exception of leading her in a wedding procession, or, occasionally riding her at a walk from one village to another, never uses her. So, the sale of her produce has to cover the expenses of her keep and leave a margin of profit. As long as grass costs nothing and grain but little, this was all very well, but now there is barely sufficient fodder to be got off the land for the plough-bullocks and grass must be bought. Grain too has gone up in price. Thus, as the mare does nothing for her own keep, she becomes an expensive luxury instead of a remunerative animal. If her produce does not sell for a good price, dies, or she sinks a few times, she becomes ruinous and is disposed of, and the zamindar, finding he has lost money, is very chary of speculating in the breeding line again.

Selection of Breeding Districts.—Having now shown some of the difficulties which have to be contended with when breeding on a large scale in this country, I will proceed to give my own ideas of how such difficulties are to be overcome.

Our object is to increase the bone, substance, and height of Indian stock, in order to meet Army requirements, and the wants of the general public, who now have to invest largely in Australians to get

the stamp of horse they desire. To do this we must have big, roomy, pure bred mares, and plenty of them. These can only be obtained, in my opinion, by selecting districts where the soil and climate are favourable, fodder cheap, and zamindars can afford to feed the young stock well. In such districts place Norfolk Trotters and no other class; get mares by continued perseverance with this stallion as closely resembling him as you can. The colts of such stock will go to Field Artillery, or if not high enough for the modern gunner's idea of a draught horse, the Calcutta, Lahore, and Bombay Tramways, and the public will buy them as fast as they are bred. The horse being a polygamous animal, we are always sure to have, when breeding on a large scale, a preponderance of filly stock. As far as possible have your Norfolk Trotter Districts together, and bear in mind that you do not want remounts from them, but breed mares.

In the districts round your Norfolk Trotter centre place your Thorough-breds and your largest and finest Arabs, putting them to mares obtained from the Norfolk Trotter centre. This cross will give you your remounts and general utility horses, but do not breed from them. Refuse all fillies that are not pure bred Norfolk Trotter for breed. In the outlying districts where fodder is scarce, the people poor and yet "horsey" in their tastes, place your Arab. He will get from the little country mare polo and racing ponies or Native Cavalry Remounts and at the worst, good transport ponies and mares who will breed fine mules if put to big European donkeys.

I am perfectly aware that breeding on a small scale is conducted in a very different manner; that each mare is selected to match and nick with a particular stallion. That good qualities in the dam should be accentuated by mating with a stallion also possessing them to a marked degree. That defects should be eradicated if possible by mating with excellencies of the opposite type. But, when thousands of mares and hundreds of stallions have to be dealt with, we must follow a general idea. The business must be worked on a large scale, and a certain percentage of failures, mistakes, and disappointments must be allowed for and taken as inevitable. But until some plan of this sort is adopted and steadily persevered in, I feel convinced we shall meet with nothing but failure. Breeding

mongrels on a hit or miss method will result in waste of money, time and discredit to those who work it, be they Government officials, Native Princes, or private individuals.

PROTECTIVE RESEMBLANCES.

By W. E. HART.

(*Read before the Bombay Natural History Society, 5th April, 1892.*)

FROM the frequency with which it is reverted to in the pages of the *Journal*, the subject of protective resemblances in the insect world would appear to be a very fascinating one. In the case with which it seems to fit into the doctrine of evolution, and the wide field it opens to interesting speculation, those who treat of it will, no doubt, be found in danger of being led into the extremes humorously noticed by "Eha" in one of his amusing contributions to the *Times of India* as "A naturalist on the Prowl." At the same time, he seems to me rather hard on those even of the extremest opinions. As I understand them, none go the length of suggesting any volition on the part of the mimic in the selection of a protected type for imitation. The perpetuation of the likeness is involuntary and brought about, not by selection, but by the fact that those members of an unprotected species which resemble the members of a protected one, have, in that resemblance, an advantage in the struggle for existence, which will be an advantage to the species in proportion as it is transmitted from one generation to another. The perpetuation of the likeness is, therefore, a process of evolution.

Nor does it seem to be insisted on, even by those who most strongly insist on the value of protective resemblances as a means for securing the perpetuation of an unprotected species, that the likeness between it and a protected one is necessarily always an *imitation*, in the strictest sense of the word. It is true such expressions as "imitate" and "mimic," are very commonly used, but often, I think in a figurative rather than a literal sense, merely because they concisely and conveniently express the resemblance between an unprotected species and a protected one, but without any intentional suggestion

that each may not independently have arrived, by the process of evolution, at the establishment of a similar typical feature which has proved useful to each in the struggle for existence. A resemblance will thus be found between them, though neither can in strictness be said to imitate the other.

In this connection, I wish to describe a very curious likeness not only in appearance but behaviour, which has come under my notice between two harmless caterpillars and a venomous snake. It suggests several questions of interest, possibly of importance, but their solution must be left to wiser heads than mine.

Among the inmates of our "caterpillar farm" described at p. 277 of the fourth Vol. of the *Journal*, was a large *Geometra* ("loofer") caterpillar, given to us by our Honorary Secretary, in whose compound on Cumballa Hill it had been found. It was then fully three inches long, and nearly as thick as my little finger, of a very dark brown, almost black colour, with the exception of a large irregular Y-shaped patch of a dirty yellowish-white near the tail end. This, when the creature's back was "looped" in its characteristic manner, gave it the appearance of a cobra, erect, with expanded hood, in act to strike. From the shape and position of the markings, this likeness was only perceptible from behind. But to an enemy meditating an attack from the rear it would be so striking as to cause an involuntary pause, during which the caterpillar, hurrying in the other direction, could easily increase its distance, if not altogether effect its escape. That this was the use of the resemblance was clear from the fact that the caterpillar always assumed what Weissmann calls its "terrifying attitude" when annoyed or startled, as, for instance, by having its tail tickled with a straw, or the floor of the cage suddenly tapped.

This specimen was of very vagrant habits, constantly effecting its escape from the cage in a mysterious way, and turning up in unexpected places at a distance from it. Possibly its activity was due to hunger, for we did not know, and could not discover its food plant, and it would not touch any of the numerous leaves which we supplied in the hope of tempting its appetite. At last it disappeared, and was only found again long afterwards behind the wainscoting, when it was what Mr. Mantalini would describe

as an "unpleasant body," we therefore failed to raise a moth from it, and so were unable to determine its species.

In the other specimen the likeness to a cobra was even stronger. This also was a *Geometra* caterpillar, of about the same size as that just described, which we found in August, 1890, at Nasik, feeding on a species of *Evolvulus*, that small creeping herb with bright blue flowers, like a tiny *Convolvulus*, which grows commonly in spreading tufts on rocky ground during the rains in Bombay. Its markings were at the head end, and gave it when "looped" exactly the appearance, from the front, of a cobra reared in act to strike. Not only so, but if the annoyance which caused it to assume the "terrifying attitude" was continued, it actually did strike, though of course quite innocuously, exactly like a cobra, in the direction of its assailant, turning for the purpose to the side or rear and with such hearty good will as sometimes to over-reach itself and fall prone. I frequently tested it, sometimes with so uninviting a subject for attack as the toe of my boot, and never failed to "get a rise out of it."

Unfortunately this specimen was lost on its way down to Bombay before it had turned into a chrysalis, so in this instance also we failed to determine the species.

Now these are to my mind two very interesting cases, well worthy of further consideration. In the first place, it will be noticed that the one first described uses its likeness to a venomous snake for the purpose of making an opportunity to avoid its assailant; but the one last described, though evidently belonging to a closely allied species, uses a very similar likeness for the purpose of making its assailant avoid it.

In the next place, it will be observed that in the latter case the likeness is more complete, not only in appearance, but in conduct.

Then comes the question, Whence the likeness? Is it because it has proved of use to the caterpillar to be like a cobra; or is it because it has proved of use both to cobra and caterpillar that a "creeping thing" should be able to suddenly assume an erect and minatory attitude with expanded crest and spectacled head?

If the former is the true answer, we are met with the difficulty that, for the likeness to be of any general use to the caterpillar, the

creatures to be terrified thereby must be assumed to be capable, not only of remembering, but of communicating to others, their experiences in regard to cobras, and these others of understanding and remembering such communications.

If the latter is the true answer, we avoid this difficulty, but are met with another, *viz.*, that the conduct of the caterpillar secondly described, in actually striking like a snake at its assailant, though powerless thereby to injure him, is more consistent with the theory involved in the first question than the second.

REVIEW.*

MR. W. T. BLANFORD and the Secretary of State (let the former have precedence on his own "midden") have sent the Indian Empire a New Year's gift of the present volume—for a consideration. They call it a "part," but we prefer when a book is published in two volumes at an interval of $3\frac{1}{2}$ years, to call them volumes. Be that as it may, Mr. Blanford's "Mammalia of India" is now a complete work; and is, and must be for many a year to come, the standard work upon the subject.

In a preface, hibernically placed at the candal extremity of the volume, Mr. Blanford points out that six of seven "volumes in which it was originally proposed to describe the Vertebrata of British India have been completed." He adds that three volumes on Moths, by Mr. G. F. Hampson, are to be added to these on Vertebrata; which is very good news, and recommends Mr. P. L. Sclater to the public for having recommended him (Mr. Blanford) to the Secretary of State, which was, perhaps, superfluous in both cases. Both gentlemen have reputations which are, or might be thought be, to above the need of "mutual admiration."

The volume now under Review begins with the Bats, and at their head is our eminent friend the Flying-Fox, who is favoured with several vernacular names that would make a Brahman Quintilian

* FAUNA OF BRITISH INDIA, INCLUDING CEYLON AND BURMA. [Why not Afghanistan and Beluchistan?] Published under the authority of the Secretary of State for India in Council. Edited by W. T. Blanford, F.R.S. Mammalia; by W. T. Blanford, F.R.S. Part II., Price 10s.

LONDON:—Taylor and Francis. CALCUTTA:—Thacker, Spink & Co. BOMBAY:—Thacker & Co.

stare and gasp. "Warbagul," for instance, is not Marathi for a flying-fox or anything else. "Wághúl," in that language is a bat, and "Wadh" a banyan tree, and "Wadh-Wághúl" or "Banyan-bat" is a flying-fox, because it affects the banyan tree for board and lodging.

"Tickell" (says Mr. Blanford in a note) "notices their preference for tamarind trees, and I think he is right. In Bengal, they sometimes remain on bamboos." One would rather like to know whether they "remain on bamboos" any longer than on tamarinds. But as a matter of fact, if a particular grove or tree suits the bats from position, they will roost there, perfectly indifferent as to species and foliage, provided it is not thorny. They can't abear thorns, because, in flapping and scrambling about the trees, their wings are in frequent contact with the branches.

Early British Administrators in the Ratnagiri District were perplexed at finding certain Banyan trees assessed as Undi trees (*Calophyllum Inophyllum*) whereof the stone of the fruit yields a marketable oil. The reason was that flying-foxes haunted the banyans, and dropped on the ground below the undigested Undi stones, whereof they had converted the pulp into living bet. The owner of the Banyan tree hereby got more Undi nuts from his Banyan tree than the original owner of the Undis; but the Maratha tax-gatherer was keen enough to find that out. Mr. Blanford, though he notices that "the trees on which the bats perch are frequently injured," takes no notice of the fact that these brutes are a scourge to all orchards of every sort.

They infest even toddy palms (and other palms tapped for juice), but do not drink the toddy in the pots. What they do is to chew the flower stem on tap.

Our author notices the yarn about these bats fishing, and thinks himself that they skim the water to drink, which is probable enough as they only do so at starting in the evening, when they have been without food or water for many hours, and do *not* do it on salt water.

The fishing hypothesis is not so absurd as it looks. One of the South American carnivorous bats has been fairly convicted of catching fish by a very similar action, and this volume records one case of ichthyophagy in the Indian Vampire, *Megaderma Iyra*. Some

naturalists, moreover, hold the flying-foxes to be not altogether Brahmans in diet.

The English nomenclature of the bats is unhappy. It is very inconvenient to any man who has any sense of Greek to find that the "Horse-Shoe Bats" are quite a different set of creatures from the genus *Hipposideros*, or as our author (who delights in breaking Priscian's head) writes *Hipposiderus*.

We want to know more about bats. The best shikar to be had out of them is as follows:—Get a foil (nothing else is fine enough) and go for that bat when he comes into your room o' nights. He dodges landing nets and defies the clumsy bamboo; but the foil is too fine and smart for him. It's equal to pig-sticking. If he can't rip, he can fly in your face, and does.

If you walk into a Buddhist cave at midday with a bamboo, or a besom, or anything else, you can generally get bats by swiping into the brown of them, but this is less artistic.

On the whole, observation of their habits is more wanted than specimens, but of course one must identify.

After the bats come the Rodents. *Pteromys "Philippensis"* is very properly discarded for *P. Oral*, for the same reason as *Ursus tibetanus* in the last volume, viz., that although the name has priority, it has not got accuracy, the flying squirrel in question not existing in the Philippines. (O si sis omnia), "Bombay skins are said by Sterndale to be grey." They are grey; from Khandesh to to Kanara. "Bus."

It was to be expected that a lot of our big red squirrels would be clubbed under *Sciurus Indicus*. But it is not clear why nothing is said of the mammae in this species, and great stress laid upon their being "6, all inguinal" in the next, *S. bicolor*. This oddity runs through the whole set of squirrel descriptions. It may be presumed that Mr. Blanford's authorities and specimens don't usually show the number of mammae; in which case any gentleman reading this, and getting a female squirrel, might do well to note the same in this Journal.

Our author doubts the specific distinction of *S. palmarum* and *S. tristriatus* but retains it, and notes (correcting Jerdon), that the former is often seen on palms. Jerdon, perhaps, never had occasion

to live in a palm-garden. *Sciurus Palmarum* is a pest to the owners of such gardens. But, on the palm, it is excessively shy, and sticks to the crown; because the bare stem gives no protection, against birds of prey. Now it is hard to observe any creature so small in the crown of a palm tree, without one is a toddy-drawer, and comes to close quarters with the "common or garden squirrel."

The Rats, of course, require much notice. But with all due respect the Indian gerbille is not *always* "thoroughly nocturnal," and very rarely seen outside its hole by daylight. In some cases it accustoms itself to man very well; and the present writer admired a colony in a railway cutting just outside a station which came out and admired him, and a whole trainful of other featherless bipeds with the coolness of London sparrows.

Our author notices this boldness in the other gerbilles, and it is probably a question of circumstances with all of them, as with most other creatures that have any sense at all.

About the Porcupines there is little new to say, except that the proper Maratha name is Sail; and that *Hystrix leucura* is the very best wild meat of all beasts of Western India. Both of which may go down for marginal notes upon our copies of the volume under review. The strange form of tail quill which receives a special illustration at p. 446, as normal with *Atherura macrura*, sometimes occurs in *Hystrix leucura*, but is less developed.

About the Hares, the most important thing to note is that the frontiers of *Lepus Ruficaudatus* and *L. Nigricollis*, in our own presidency, are not yet "scientific frontiers," which is not creditable to us. They are probably not far from the latitude of Bombay or a trifle north of it in the Konkan and south of it in the Deccan. If anything this boundary is too far north, there must be a debatable land: as there is no boundary that would stop a hare either above or below the ghât. *Nigricollis* occurs north of the Waitarna.

In the *Proboscidea* Mr. Blanford recognizes only one Asiatic Elephant. The notice is rather meagre, but two passages are worth transcribing: "the ankle joint or heel in the hind leg, corresponding to the hock in other ungulates, is very little raised above the ground" (he might have added "and inconspicuous"); "and the only pace

of elephants is a walk, slow or quick, at time increased to a shuffling run. They are incapable of any motion resembling a gallop or of the least jump." Every man who is going to draw an elephant and ought to learn these sentences by heart, albeit one is as incomplete the other as awkward as the elephant's 'shuffling run.' Artists usually draw elephants with hooks, and then reviewers correct them and say that elephants "have no hooks." *Arcades ambo.*

Tame elephants very rarely breed in India. A good observer told the writer that he had witnessed their nuptials at Pauna in Bundelkhand many years ago, which differed in no material point from those of other quadrupeds. There are other (some very old) authorities for this, and mahout lies to the contrary; now the mahout is of all men the premier liar, and the close companionship of elephants is, indeed, more corrupting than even that of the horse. Whereof a tale of Bengal,—(Mr. Raikes's, we think) Baxu, dealer in elephants took several to a fair and sold all but one; and around this sole survivor there walked an uncommonly shrewd-looking one-eyed Rajput stranger examining him closely. "Sir," said Baxu, "I perceive that you are a judge of elephants. You are also my father and mother and a few other relations,—and what's more I see the Raja of Dastypore's Diwan coming up to look at this elephant, and if he buys him, you shall have 50 rupees." The Diwan did buy the elephant, and Baxu, who fancied that the stranger had detected the 'screw loose' that had so long kept that elephant on his hands, paid up, and said he, "Sir, I thought I knew how to 'fake' a screwed elephant if any man in Hindustan does, but you are my master. How did you find him out?" "My brother," quoth the judge of elephants, as he put a 'granny' knot on the rupees in his sash, "the truth is that I never saw an elephant before, and I was seeking to discover which end of the brute was his head, and which was his tail."

Our tale is at this end for the present.

MISCELLANEOUS NOTES.

No. I.—NOTE ON *ANGRACUM SESQUIPEDALE*.

(Read before the Bombay Natural History Society, on 26 January, 1892.)

The orchid which I exhibit to-night is an *Angracum*, a native of Madagascar; it has been in my possession about four years, and has flowered regularly every season.

The *Angracum* belongs to the tribe *Vandee*, and in some degree resembles *Aerides*, having, like them, the stems clothed with ever-green leathery distichous foliage, which in some kinds is curved and graceful, while the flowers are produced in long racemes from the leaf axils. The flowers are characterised by the spreading sepals and petals, and by the long slender spur to the lip, which has a spreading entire or 3-lobed limb.

This particular species "*Angracum sesquipetale*" is described by Williams in his "*Manual on Orchids*" in the following terms:—

"A wonderful and noble plant of great beauty. It was brought to England by the late Rev. W. Ellis of Heddleslow from Madagascar, where he found it growing on trees. The stem is simple and rooting; the leaves close-set, distichous, leathery, oblong, blunt and bilobed at the apex, keeled, and of a dark green colour. The flowers are of a clear ivory white and very large, a foot across, with a greenish tail or spur from 12 to 18 inches in length hanging from the flower. The peduncles are axillary, and bear from one to four of these fragrant flowers, which are produced in November, December and January, and last about 3 weeks in beauty. There are two varieties, one having larger flowers than the other."

It is the smaller plant that I have shown this evening.

As regards the treatment of orchids generally, my experience is that in Bombay they have to be protected from the sea-breeze and red dust. Dirt, of course, to any orchid, is poison, and it is one of the trials of my life to see the *chota mali* brushing the pathways next the orchid-house, raising a noble cloud of dust, which settles lovingly and lastingly on the foliage of the orchids. A prolonged course of this dusting is quite sufficient to kill any orchid. Cleanliness in orchids is so much insisted on that in most manuals you will find advice to readers to wash the foliage with sponge and soap.

Orchids require a fair amount of sun; the ordinary Bombay fernery netting seems to admit the right amount. Creepers growing over orchid-houses are, I find, a mistake. Recently my orchids in one house were looking dull and depressed and anything but healthy. The fellow-plant to the one exhibited dropped its flowering stem, and I discovered that the creepers had grown so thickly over the roof of the house as to obscure the sun's rays. I at once had the creepers cleared away and the plants have recovered.

Water of course is essential. I water my plants once a day all the year round except in the rains. Excess of water is liable to damage the plants, and I find that bulbous orchids especially are liable to rot off in the rains. It is most difficult to make the *mali* understand how to moderate the supply of water, and also to syringe the orchids instead of watering them from a bucket. In the hot weather the floor should be kept well damped. It will help your ferns as much as your orchids, and in my experience this is most essential in all ferneries, especially where you cannot have artificial tanks in the houses.

There is a good deal also in selecting the right spot in which to place an orchid in your fernery. This knowledge can only be obtained by carefully watching the progress of your plants, and moving them about until the healthy appearance and growth of your orchids indicate that they are in suitable localities. As regards the method of growing orchids, I find as a general rule they do best in pots with charcoal and brick or broken potsherds and a little moss on the surface, especially in the hot-weather months. In the rains the moss can be removed. Many orchids do well on slabs of teak, but when they grow much they are too big for the wood and it is a troublesome task to remove them. Terrestrial orchids of course require the ordinary potting. Do not attempt to grow hill orchids in Bombay. Barton-Groves writes:—"It is useless attempting to cultivate in the plains hill orchids which grow at an altitude above 2,000 ft. They will probably blossom the first season, but then either die off at once or dwindle away by degrees."

Lastly, do not leave the charge of your orchids to your *mali*, for this will be but to court failure. Orchid culture requires much patience and constant care and attention, which only the *madam sahib* or *sahib* will give.

Bombay, 20th January, 1892.

M. C. TURNER.

No. II.—*SEPTICÆMIA IN A DEER.

The case in question occurred in a young, tame, female deer that had been bitten by a dog. The owner being ill, it was left to the care of native servants, and was not properly attended to until 10 days after the injury had been inflicted. When admitted to hospital on the 13th November, there was a large wound on the near quarter, extending almost the whole length of the femur down to the patella. The edges of the wound were deeply under-run, and the whole was fly-blown, the triceps, external, vastus and ischio-tibialis muscles being in a gangrenous condition and sloughing. There was also a deep ulcerated wound at the back of the limb, about an inch above the point of the hock, and the gastrocnemius tendon was badly torn, a large portion afterwards sloughing away. The wound was cleaned, the gangrenous portion of the skin and muscles removed, the whole irrigated with corrosive sublimate solution, 1 in

* The above appeared in the *Veterinary Journal* for January, 1892.

1,000, and afterwards dressed with iodoform. On the 16th there was considerable erysipelas of the whole of the tibial region. This was treated with belladonna externally, and fine. ferr. perchlorid 4 minims, and pot. chlor. 4 grs. in a draught morning and evening. On the 18th all symptoms of erysipelas had vanished, and the treatment was discontinued. The case did well till the 20th, when the temperature rose to 103°8 with a muco-purulent discharge from both nostrils. The animal was found dead at 6 a.m. on the 21st.

Post-mortem at 11 a.m., 21st November, 1891.

The body was well nourished. At the umbilicus a hard tumour was felt. On dissection of the wound, the whole of the adjacent muscles were infiltrated with minute abscesses. The sacrosciatic nerve was highly inflamed, and there was a large clot in the popliteal vein. The inguinal lymphatic glands were highly inflamed, and showed numerous points of pus on section. The ilio-cæcal valve was highly congested. The rumen showed four deep ulcers, with the characteristic raised edges. The lungs showed old adhesions on both sides, but more particularly on the right. Both lungs were in a gangrenous condition, and were simply a mass of minute abscesses, especially the right one. The heart was adherent to the pericardium, and both it and the endocardium had well marked ecchymosis on them. The right side of the heart was almost filled up with a large ante-mortem clot, that passed right through the auricular-ventricular opening. The tumour felt at the umbilicus turned out to be 8 hair-calculi in the rumen, that altogether weighed 3½ ozs. There was an entire absence of the new mown hay smell that is so characteristic of septicæmia in the human being.

This case appears to show how little chance there is of deer living that have been wounded and escape into the jungle, and how, from motives of humanity, sportsmen should refrain from firing "Long" and "Snap-shots."

J. A. NUNN,

Principal, Lahore Veterinary School.

NO. III.—A TUBICULAR ANNELIDE.

On the beach of Mahim—not the Bombay Mahim, but that 50 miles north of it, best known as Kelvi Mahim—I came across an annelide worth describing, as some one may identify it.

The tube was leathery, about 6 inches long, and one-sixth of an inch in extreme diameter, of a dirty fleshy-white colour. About four and a half inches of this tube were attached to the underside of a loose stone some 10 inches by 6, and 3 inches thick; such a stone as one would think rather too big to throw at a dog, but not too big to dash down upon any object which might deserve that attention. This attached part of the tube was much flattened to the stone and greatly contorted. The remainder was straight, free, and cylindrical, bearing at its end at the surface of a tide-pool, wherein

the stone lay, the usual flower-like tuft of branchiæ. These were not as usual crimson or whitish, but of a very rich chestnut-colour. I watched them for some time, and found them extremely sensitive to light. My movements affected them but little. But on moving my stick so as to bring a mere pencil of shadow (that of a steel point) across the branchiæ, they immediately retreated with a jerk into the tube. The stick itself was a foot above the water, and no motion of it, or of my body, affected the action of the annelide until the tiny shadow fell upon it with as sharp and instant effect as that of red-hot iron.

This is a great neighbourhood for the tubicolar annelides. *Serpula* builds reefs here that would not be a disgrace to some of the corals, and the sands are full of the great sea-caddis (*Terebellæ*).

In a general way, however, the beach is not rich, the most noticeable thing (in the walk now recorded) was an immense number of small olive-gray *Aplysias*, with white spots, apparently beached against their will, and dying.

Oddly enough, while observing these, my attention was attracted by the sound of heavy rifled ordnance from Bombay; over 50 miles away, and not up wind either.

KESWAL.

No. IV.—“ST. BRANDAN’S ISLE.”

It is a trifle hard to say whether a meteorological phenomenon comes within our scope or not.

At any rate, on the 11th February, 1892, there was visible from Mahim Fort, Tanna district, an unusually distinct appearance of the “Fata morgana,” “St. Brandan’s Isle,” or (as it is best known to sailors), “Cape Flyaway.”

West and North of West was a bank of clouds; unmistakable enough, clear of this, from W. by S. to W. S. W., was a group of mountainous islands apparently about 30 miles away; but clearly reflecting the coast ranges behind us, distant from our backs, the nearest about 8 miles in a straight line, the furthest, perhaps 20.

I called up two boatmen, who spontaneously remarked the identity of the apparent island with the hills to the east. They had no knowledge of any legend about such things, but thought them a sign of doubtful weather. There was no inversion of anything.

No. V.—SPORT IN THE ISLAND OF KARATIVOE.*

Off the North-west coast of Ceylon, and about a mile and a half from the mainland, is a long narrow island called Karativoe, very little known, and of almost no mercantile importance, its only merit in this sense being that it is, at

* The above appeared in *The Field* on 30th January, 1892.

certain times of the year, used as a fishing station by the natives of the colony. Excepting in the season, when the Singalese fishermen visit it to catch fish for the purpose of drying and salting, it is wholly uninhabited, unless, indeed, it be by a few Chinamen, who go there to catch the sea-slug (called in Tamil "attai") which abounds on this part of the Ceylon coast. These slugs—I do not know their correct scientific name—are large things about 8 in. or 10 in. in length, black and slimy, and of a most uninviting appearance when freshly caught, but when boiled they shrivel up to very small dimensions, and lose a great deal of their repulsive look. I have never tried them, but they are esteemed a great delicacy among the Celestials. But if the island is, in all important respects, insignificant, it is, looked at from the sportsman's point of view, a perfect paradise. Its entire length is about ten or eleven miles, and its breadth at the widest part, which is at the north, about a mile. It is mostly composed of loose sand, covered with scrub jungle and large mangrove swamps, but there are a few glades of coarse grass here and there, and plenty of springs of excellent water. It simply teems with deer, or did a few years ago, when I was shooting there. How they got there is somewhat a mystery. The prevalent idea is that they were introduced by some old Dutch grandees before the occupation of Ceylon by the English, and there is some colour to this opinion, from the fact that there is a ruined old building on the island, which may possibly have been a sort of shooting box in the time of the Dutch.

It was early in January when I made a solitary hunting trip there. I took a native dhoney, and sailed through the Calpentya Lake and past Dutch Bay, and after a twenty-four hours' run, reached the north of the island. At this season there were fortunately for me, a large number of Singalese fishermen there; they had their "kottoos" or huts all along the shore, and they proved invaluable allies in driving the deer. These men were nearly all Roman Catholics from the towns of Colombo and Negombo, and consequently had no Buddhistical scruples about hunting or taking life; in fact, they were very keen sportsmen, and very obliging fellows to boot. The golden plover simply swarmed in many parts along the coast, and curlew, whimbrel, and every description of waders were to be seen in great numbers about the shallows of the lagoons, while large packs of wild fowl were floating about well out of range from the shore. The grey partridges also were very plentiful, and in the early morning and evening could be heard culling all over the place. It should be understood that the west coast of the island faces the high sea, but between the east coast and the mainland of Ceylon is one of those backwaters so common along the north-western coast; comparatively smooth, and in many places very shallow, and it was here that the wild fowl, curlew, &c., were to be found.

The first morning (Jan. 8) I tried stalking. The place is not very favourable from it being very bushy, and having very little grazing ground in the open. Any amount of fresh tracks of deer were to be found, and twice I found a small

herd but they were among the bushes, and only offered snap shots which failed to do any execution. Coming home, or, more properly speaking, to the boat, for we made it our camp, we saw four magnificent ducks in one of the lagoons about 80 yards from the shore. They were a very rare kind, called in Tamil "chemboo-tara" (copper duck), as large as a Brent goose, and of a golden colour; hence the name. I tried to get near them, but they kept on rising just out of shot and pitching a little further on, until at last I resolved to try a shot with the rifle at them. The bullet appeared to pitch within an inch of them, but clearly did no damage, for they got up and flew out of sight, to my great disappointment. In the evening I again found deer, and bagged a doe, and had good sport with golden plover and whimbrel along the shores of the lagoons.

Next day (Jan. 4) I persuaded a lot of the Singalese fishermen to come and drive the jungle for me, and they willingly complied, and proved capital beaters. It was not at all easy shooting, for the bushes were very thick, and the deer nearly always avoided crossing what open spaces there were. The first chance I had was at a grand buck, who galloped past me within 40 yards, and I managed to miss him carefully with both barrels, but in the next two drives I was lucky, and bagged a buck and a doe. We were having the last drive of the morning, and a magnificent buck, with a grand head, broke cover some 50 yards from me and presented a side shot. I distinctly heard the bullet strike, and saw the deer stagger, but he galloped on through a mangrove swamp, and out on to the mud bordering the lagoon. He was going weakly, and I ran after him as fast as I could, but it was very bad going, first in the loose sand and then in the mud, and he got a long way from me. He held on through the mud, and then took to the water to swim across the lagoon, which was about 150 yards wide. He presented a fine picture, boldly striking out, and every now and then turning his grand, antlered head, as if to look back at his enemies. He was evidently making for some thick covert on the opposite shore. I could not get very far out on the mud, but fired three shots at him from where I was. It was a long range, and I was shaking from my run, and, of course, missed him. By good luck, however, there were two or three fishermen on the opposite side, and they saw the buck swimming, and one of them waded out into the shallows, and got up to the deer who was nearly exhausted by his wound and long swim, and killed him with an oar. He was afterwards brought over to me, and I found that my bullet had struck him behind the shoulder but too low down. It was satisfactory that he should be brought to bag, rather than die a lingering death in the jungle. This made our third deer—two bucks and a doe—and we considered that we had had a good morning's sport.

In the afternoon we beat for partridges. I had no dogs—they would not have been of much use there, and would probably have been knocked up by the sun, the heat being intense—but employed three of my boatmen to beat

the bushes, while I kept a little ahead of them. It is very pretty shooting. The birds are very much like the English ones about the back, but have dark bars on the breast, and pink legs, armed, in the case of the cocks, with sharp spurs half an inch long. They fly very well, though not quite so sharply as the home bird. I have weighed a great many large individual birds, and have often got an old cock of 15 oz.; but this is exceptional, the ordinary weight being from 11 oz. to 13 oz. They are excellent eating, but owing to the climate, cannot be hung long enough to get the true game flavour. We found plenty of birds in the north of the island, and had excellent sport with them.

The white-headed fish eagle was very common. These grand birds often measure over 6 ft. across the wings, and their strength of talon is wonderful. I saw one do an extraordinary thing; he pounced down on to the lagoon, seized a good-sized fish, fully $\frac{1}{2}$ lb. and soared upwards with it in his talons. He was some 90 yards or 100 yards distant, and I fired at him with the rifle. The bullet no doubt whizzed close to him, for he gave a twist and dropped the fish, but instantly he darted downwards again, and caught it almost as soon as it touched the water, and bore it off.

On the following day (Jan. 5) we had another deer drive, and I bagged a buck, missing two other chances, and then we left the island and sailed across the back water to the mainland. We landed at a place called Kuthurai Mallee (Horse Mountain). Why "horse" I cannot say, but there is a small hill there which is very remarkable, considering the unvarying flatness of the rest of the coast. There was a miserable little hamlet in the neighbourhood, where there were a few Tamils, and one of them undertook to show me a place where bears came at night to drink. We found the fresh track of one bear near a small pond, and I determined to watch there. This particular bear had a certain notoriety about there, from the fact that he had a lame foot, as his track plainly showed. The natives of the village spoke of him as "the cripple," and I was told that he had been shot at more than once.

It was not the best time of year for night shooting, being the wet monsoon, but in this part of the island there is never a very great abundance of standing water; the sandy soil absorbs the rain almost as fast as it falls. It was a good moon, and we watched the pool through the night, but no bear appeared. In the morning we went and examined another pool, about half a mile distant, and found that our lame friend had paid it a visit during the night: his peculiar track could not be mistaken. We resolved to watch here in the night, and placed pieces of newspaper on the bushes surrounding the other pool. This was done with the idea that, if the bear went there, he would be frightened by the appearance of the paper, and might possibly come to our pool: but as we afterwards found, he never went there at all. It was about 2 a.m. when we heard the welcome rustle in the jungle which told of the advent of bruin, and when he came to the water he gave a splendid shot under the clear moonlight. The bullet caught him well behind the shoulder; but, as is usually the case,

he bolted off yelling into the jungle. In the morning we found him lying dead with a stick between his teeth, not more than 50 yards from the pool. He was an old male, and one of his hind feet had been wounded in some way, either by a bullet, or very likely in a fight with one of his kind. It was an old wound, and had long since healed. At any rate, the foot had a clubbed appearance, and accounted for the peculiar track which he left, which had obtained for him the *soubriquet* of "the cripple."

JESSE.

NO. VI.—A TIGER ATTACKING ELEPHANTS.*

I fancy that it is in the *Field* that I have seen it stated more than once that a tiger will not attack an elephant, or that, on the rare occasions when it does venture to attack one of these huge brutes, it always gets the worst of it. The following facts will, however, I think, help to disprove these statements:—In September last, a timber contractor reported to me that a female elephant and calf had been attacked by a tiger when they had been turned loose to graze at the head-waters of one of the streams which rise in the Pegu Yomahs, and that the calf had been killed. I hardly credited the report at first; but on inquiry, I found that it was perfectly true. From the footprints it was evident that the tiger had tackled the calf (a two-year old male) when it had strayed from its mother. The mother had come to the rescue, but was unable to do anything and only got badly mauled about the hind quarters, and was apparently driven off; the calf was killed, and found partly eaten the next day. That night a row of spring spears was set by the Karens (who are very outo at this sort of trap), and in the morning it was found that one of these had taken effect and the tiger had gone off with about 3 ft. of it. The greater part of that day the brute was heard in a large paing grass jungle, roaring, and evidently not at all pleased with the 3 ft. of bamboo. The next that was heard of him, three months later, was that he had lifted two bullocks from a Cutch camp, about forty miles from the scene of his former exploits. Shortly after, another attack on a contractor's elephant was reported. It was evident, from the marks on the ground, that the animal, which was a full-grown female, had been caught when asleep; and when I saw it a week afterwards it still had dreadful marks on the top of its shoulders and in the centre of the back, which could be the work of nothing else but a tiger. It is more than probable that it was the same tiger which had killed the calf three months before, for he was evidently very lame, if not maimed, the marks of three feet being distinct, whilst only the claws of the fourth just touched the ground. The spear had evidently nearly given him his *quintus*.

Four days afterwards a tiger tackled another elephant, this time a big tusker, worth over Rs. 2,000, which died five days after. In this case it would

* The above appeared in *The Field* on 13th February, 1892.

appear that the elephant was in a narrow and shallow nullah with steep banks. The tiger jumped from the bank, and was shaken off more than once, but returned to the charge again and again. The elephant, however, got off with its life for the time being, and was taken into the nearest village with dreadful wounds along nearly the whole length of its back, the points where the tiger had apparently concentrated his attacks being the backbone about a foot in front of the root of the tail.

The tiger, I am sorry to say, is still at large; the Europeans in the district are all officials, and are too hard-worked to spare time for a tiger hunt; whilst a party of Burman shikarries who have gone out, urged on by the offer of a reward, have as yet had no luck.

G. Q. CORBETT, Deputy Conservator of Forests.

Thanawaddy, Lower Burma.

PROCEEDINGS.

PROCEEDINGS OF THE MEETING HELD ON 26TH JANUARY, 1893.

The usual monthly meeting of the members took place on Tuesday, the 26th January, Dr. G. A. Macdonachie presiding.

The following gentlemen were elected members of the Society:—

His Highness the Gaekwar of Baroda, Captain H. R. Tufnell (Neemneh), Lieutenant C. H. Ward (Fyzabad), Dr. Manockjee Dossabhoj Cama (Bombay), Mr. W. G. Wood (Naini Tal), Mr. C. P. George (Secunderabad), Mr. Frank Field (Behar), Dr. Naderahaw H. E. Sakhi (Bombay), Mr. G. J. Nicholls, B.C.S. (Benares), Captain A. L. Hibbert, B.A. (Belgaum), Mr. A. V. Munro (Mooltan), Mr. N. D. Glazebrook (Bombay), Mr. Mathew Leam, F.W.D. (Vizagapatam), Captain Meade (Resident, Bhopal), Mr. Curroombhoj Ebrahim (Bombay), and Professor W. H. Sharp (Bombay).

CONTRIBUTIONS DURING DECEMBER, 1891.

Contribution.	Description.	Contributor.
2 Spotted Doves (alive). ...	<i>Turtur suratensis</i>	Miss G. O'Neill.
2 Pin-tailed Sand Grouse (alive).	<i>Pterocles alchata</i>	Mr. W. Gamming.
1 Torpedo Fish	<i>Narcine tinnlei</i>	Mr. Ardesair Dadabhoj.
1 Panther's Skin	<i>Felis pardus</i>	Mr. B. S. Gupta.
1 Bird's Skeleton	<i>Erithacus rubecula</i>	Mr. W. F. Sinclair, C.S.
2 Red-Crested Wood-Quails (alive).	<i>Rollulus roulroul</i>	Purchased.
2 Bronze-Winged Doves (alive).	<i>Chalcophaps indica</i>	Do.

Contribution.	Description.	Contributor.
3 Bird-eating Spiders (alive).	<i>Mygale fasciatus</i>	Mr. H. B. P. Carter.
1 Skin of the Crested Grebe.	<i>Podiceps cristatus</i>	Mr. H. Bulkley.
1 Egg of do.	From Kharaghora.....	Do.
1 Egg of Bustard	<i>Eupodotis edwardsi</i>	Do.
1 Eight-Legged Puppy ..	<i>Canis familiaris</i>	Miss Hale.
24 Birds' Skins	From Central Provinces ...	Mr. N. S. Symons.
1 Jungle Cat	<i>Felis chaus</i>	Do.
1 Kingfisher (alive).	<i>Halcyon smyrnensis</i>	Captain Mitchell.
1 Bittern	<i>Botaurus stellaris</i>	Mr. W. Murray.
1 Cobra	<i>Naga tripudians</i>	Major Gerald Martin.

MINOR CONTRIBUTIONS.

From Colonel K. Mackenzie, Mr. W. Shipp, Captain Shopland, and Mr. V. H. Pathare.

CONTRIBUTIONS TO THE LIBRARY.

"Catalogue of the Dipterous Insects of the Oriental Region" (Bigot), from the Author; "La Nature," for 1890-91, from Dr. W. Dymock; "The Indian Forester"—No. 12, in exchange; "A Monograph of the Oriental Oicadidas" (Distant), Part IV., in exchange; "Indian Museum Notes," Vol. II., in exchange; "The Fauna of British India—Mammalia," Part II., (Blandford), from the Author. "North American Fauna," No. 5, in exchange.

THE CRESTED GREBE.

Special attention was drawn to the skin and egg of the Crested Grebe received from Mr. H. Bulkley, of Kharaghora, where the bird was found breeding in August last. This is the first instance on record of the Crested Grebe having been found nesting in India.

AN EXHIBIT.

Mr. M. C. Turner exhibited a beautiful specimen of a large white orchid (*Angraecum sesquipedate*), from Madagascar, which was greatly admired, and read a short paper on the difficulties which attend the successful culture of orchids in Bombay.

THE MAMMALIA OF SOMALI-LAND.

The Honorary Secretary read the continuation of Mr. J. D. Inverarity's interesting paper on Somali-Land, containing an account of his two sporting tours in that country.

The following papers were also read:—"The Protection of Game in Sind," by W. S. Hexton. "The Butterflies of Travancore," by H. S. Ferguson, F.L.S. "Note on *Cassia grandis* and *Cassia marginata*," by G. M. Woodrow. "Branching Palms and Tree-Ferns," by L. de Nicéville. "The Protection of Larvæ," by E. H. Aitken.

Doctor Macdonald proposed a vote of thanks to the authors of the various papers, and the meeting then ended.

PROCEEDINGS OF THE MEETING HELD ON 1st MARCH, 1892.

The usual monthly meeting of the members of this Society was held on Tuesday the 1st March, 1892. Mr. Andrew Murray presiding.

The following new members were elected:— Captain C. H. R. Browne, P.W.D. (Bombay), Captain G. H. Leach, Looshai Hills (Cachar); Mr. E. M. Thomason (Sheogarh); Mr. E. E. Fernandez (Baroda); and Dr. Dhargalker Luxmon (Bombay).

The following contributions were acknowledged:—

CONTRIBUTIONS DURING FEBRUARY, 1892.

Contribution.	Description.	Contributor.
1 Owl (alive)	<i>Strix javanica</i>	Miss Atkinson.
1 Brown Flying Squirrel (alive)	<i>Pteromys oral</i>	Mr. J. David.
1 Green Tree Snake	<i>Dryophis mycterizans</i>	Dr. T. S. Weir.
1 Porcupine's Skull.....	<i>Hystrix leucurus</i>.....	.....
Deer's Horns	<i>Rucervus eldii</i> .....	.....
2 Sarus Crane's Eggs	<i>Grus antigona</i>	Capt. A. Gwyn.
1 Snake	<i>Lycodon aulicus</i>	Mr. C. E. Kaus.

MINOR CONTRIBUTIONS

From Mr. G. Owen Dunn, Mr. O. J. Michael, Mr. J. Benjamin, Mrs. Aston, Veterinary Captain J. Mills, and Captain A. Gwyn.

CONTRIBUTIONS TO THE LIBRARY.

"The Fauna of British India (Blandford)—Mammalia," Vol. II., from Mr. W. F. Sinclair, C.S.; and "Pharmacographia Indica," Part V. (Dymock), from the author.

EXHIBITS.

The Hon'ble Mr. Justice Birdwood exhibited a fine specimen of *Gleichenia* grown in Bombay, and Mr. M. C. Turner sent two beautiful orchids in flower, viz., *Phaenopsis schilleri* and *androbium aggregatum*, which were much admired.

THE ACCOUNTS FOR 1891.

The Accounts of the Society for the year ending 31st December, 1891, were laid before the meeting by the Honorary Treasurer, Mr. Andrew Murray. The total expenditure during the year amounted to Rs. 8,932 (out of which Rs. 4,316 were spent on the Journal), and a balance of Rs. 1,454 was carried forward.

The Accounts were passed subject to the usual audit, and a vote of thanks was passed to the Honorary Treasurer.

LANDSCAPE GARDENING IN NATIVE STATES.

The Honorary Secretary read an interesting paper on the above subject, by Mr. H. St. John Jackson, of Allahabad, containing descriptions of the gardens which had been laid out at Jeypore, Gwalior, Coodeypore, Darbhanga, and other places. The paper appeared in No. IV., Vol. VI., of the Journal.

DISEASES OF FIG TREES.

Dr. J. G. Lisboa then delivered a lecture on what appears to be an hereditary disease of the branches and leaves of the fig-tree known as the Piprae (*Ficus teiela*). This tree occurs in large numbers on the road between Poona and Mahableshwar, and those who have travelled along that road must have noticed a curious phenomenon presented by the tree. From its branches may here and there be seen hanging large green balls, like Chinese lanterns. They are composed entirely of numerous small leaves, thickly congested on small branchlets, which are also numerous and congested on larger branches. As seen from a distance one is apt to infer that the leaves have been brought together either by spiders or red ants, but closer examination, shows that the leaves are free, and that the appearance is due to the innumerable short branches shooting out in close proximity to one another and bearing small closely imbricated leaves. The branch of the tree thus affected gradually dies. The lecturer stated that these abnormalities were, in his opinion, due to an hereditary disease, and were not caused by either a fungus or by insects.

A vote of thanks was passed to Dr. Lisboa for his valuable lecture, which was illustrated by means of photographs and specimens.

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of Account from 1st January, 1891 to 31st December, 1891.

RECEIPTS.	Rs. s. p.	EXPENDITURE.	Rs. s. p.
Balance in the Bank of Bombay on 1st January, 1891	1,514 10 10	Rent of the Rooms from 1st December, 1890, to 30th November, 1891, at Rs. 100 per month...	1,200 0 0
Cash with the Honorary Secretary on 1st January, 1891	29 10 0	Salaries from 1st December, 1890, to 30th November, 1891	1,144 0 0
Subscriptions for 1890 (in arrears)	135 0 0	Furniture Account	247 1 9
Do. " 1891	7,006 4 0	Cost of Printing Journal and Coloured Plates from England	4,310 1 2
Do. " 1892 (in advance)	45 0 0	Printing and Stationery	493 13 9
Do. from Members out of India	204 0 0	Library Account	88 2 0
Entrance Fee	870 0 0	General Expenses	1,432 2 11
Sale of 3 Camp Beds	65 0 0	Balance in the Bank of Bombay on 31st December, 1891	1,454 11 3
Miscellaneous Receipts	426 8 0		
Total.....Rs.	10,386 0 10	Total.....Rs.	10,386 0 10

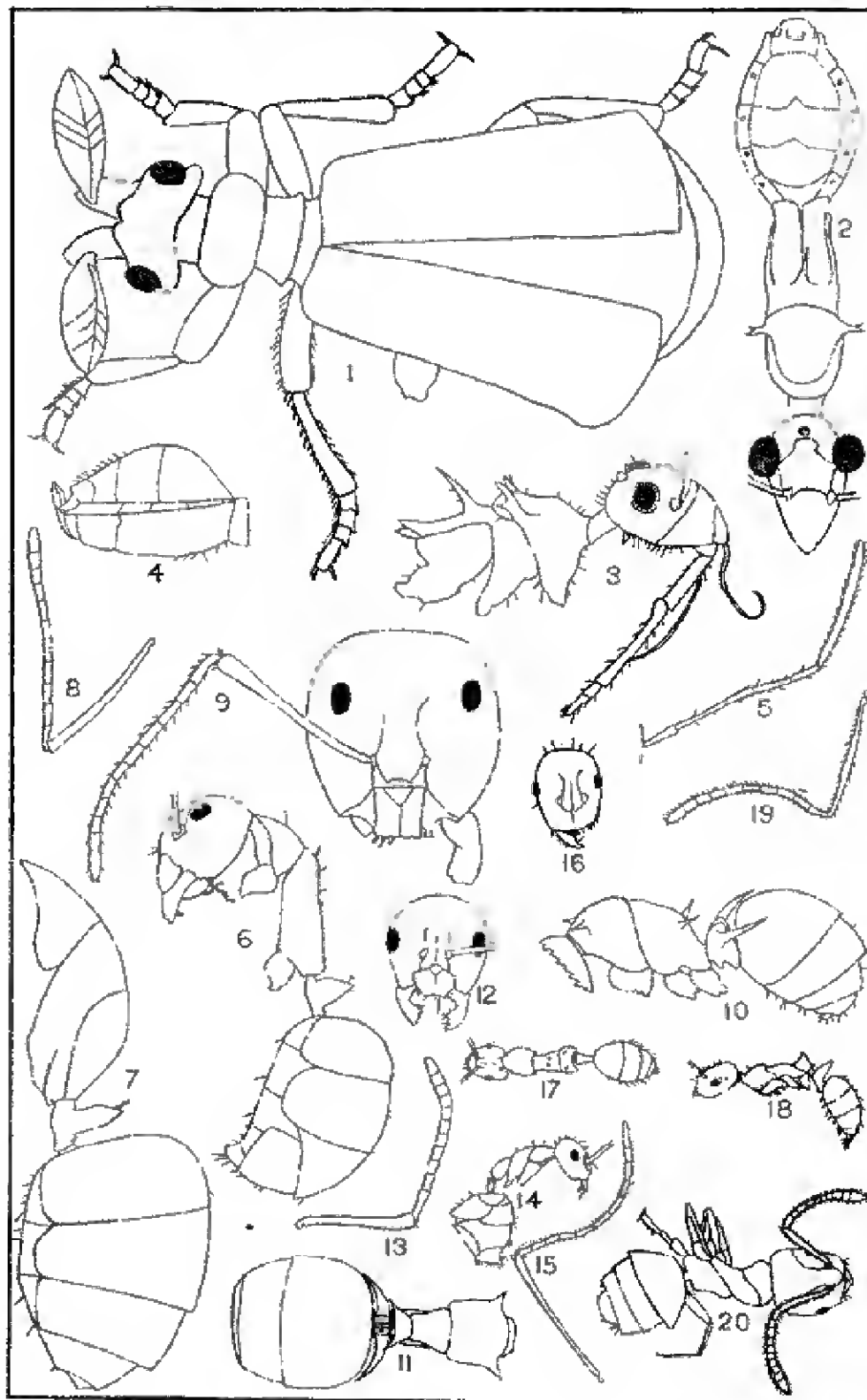
ANDREW MURRAY,

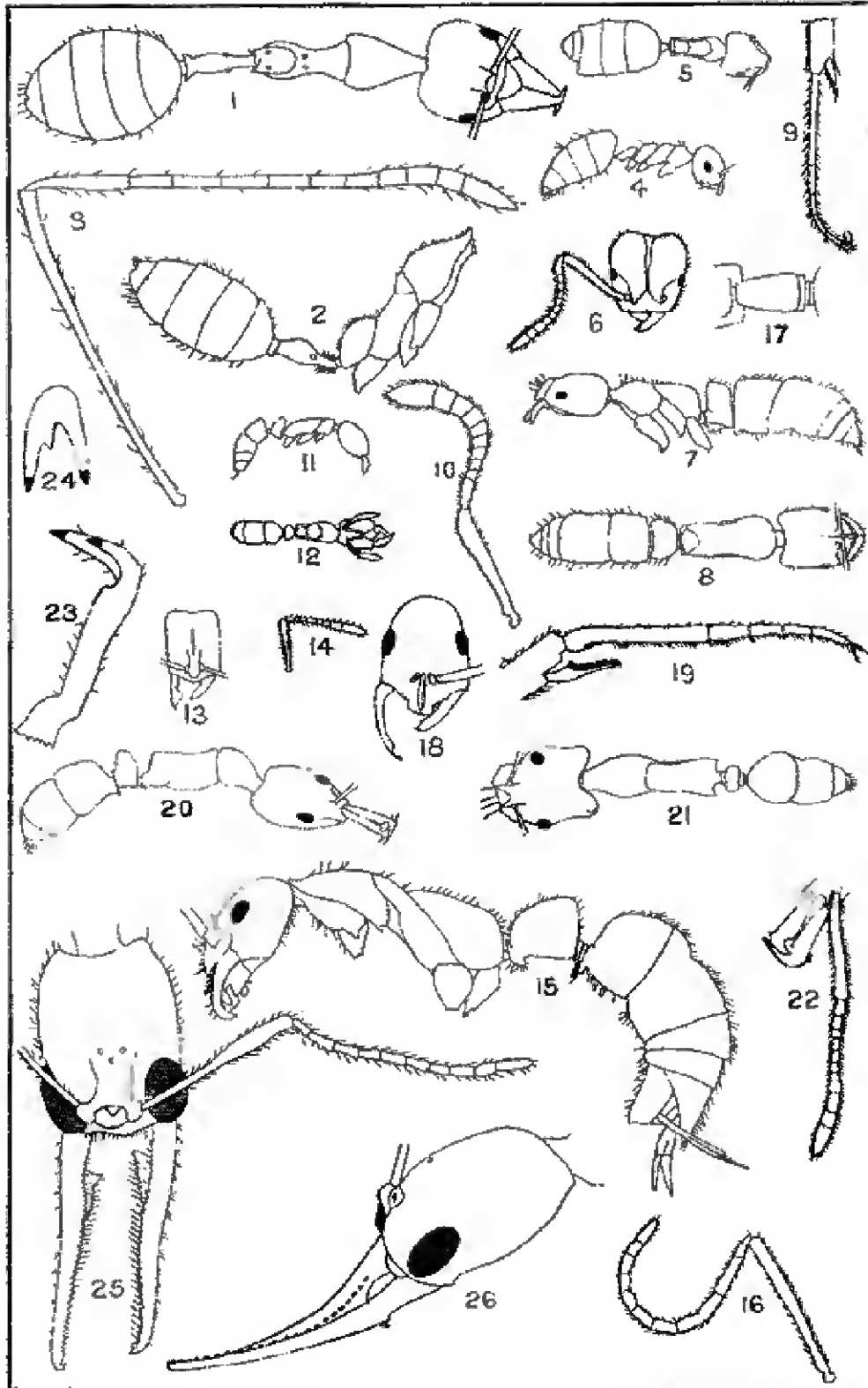
Honorary Treasurer.

Bombay, 31st December, 1891.













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